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THE ORIGINAL REIS TELEPHONE.

In the summer of 1884 the counsel of the Overland Telephone Company obtained from Professor Silvanus P. Thompson, in London, the identical transmitter and receiver exhibited and used by Philip Reis in his lecture before the Physical Society of Frankfort, in 1861. These instruments were received by Professor Thompson from Dr. Theodore Stein, of Frankfort; and in order to verify their genuineness, the testimony of Dr. Stein was taken, and he proved that they were given to him by Professor Bottger in 1862, who assured him that they were produced and used by Reis at the meeting of the Society. Dr. Stein kept them in his possession until 1882, when he delivered them to Professor Thompson. During some recent experiments with reproduced forms of Reis telephones, made by Professor J. R. Paddock, of the Stevens Institute, this original telephone was submitted for examination. Professor Paddock, assisted by Mr. E. W. Smith, a skillful operator, long employed in the use of Bell telephones, had obtained such remarkable results that he determined to test this original instrument. It was nearly twenty-five years old, and somewhat battered, but all its parts were perfect except one of the wooden supports of the needle; and Professor Paddock and Mr. Smith soon succeeded in proving that, without any change or addition whatever except a single wooden support, it was capable of transmitting articulate speech. The results of their efforts are given at length in their testimony, taken September 19, in the Overland cases, which clearly shows that this instrument, described by Reis as a telephone and publicly used by him a quarter of a century before Bell's patent, will now transmit articulate speech. We have been permitted by Professor Paddock to make an exact drawing of this interesting instrument, which is shown on this page.

Of course in the state of our patent law the public use of such an instrument abroad would not be sufficient, in itself, to defeat Bell's subsequent patent. But in the yearly report of the Physical Society for 1860–61, Reis' lecture on "Telephony by Means of the Galvanic Current" was published, containing an exact drawing of the transmitter, and a full description of both transmitter and receiver, with directions as to their use.

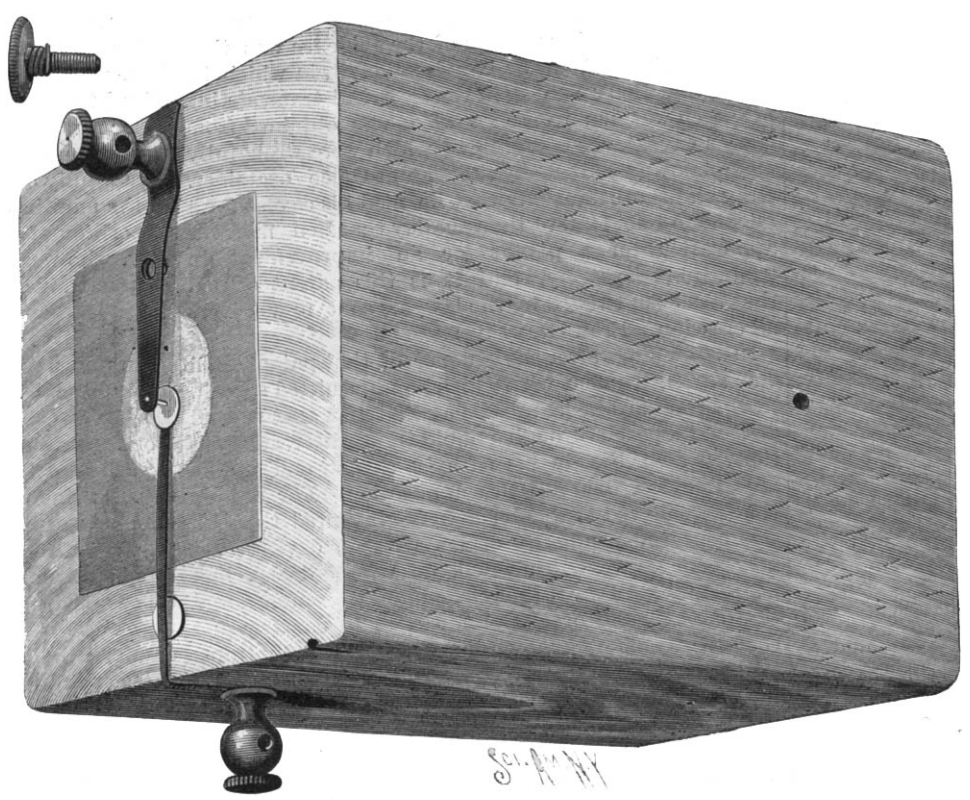

Fig. 1.—AN ORIGINAL REIS TRANSMITTER—FULL SIZE.

The body of the transmitter consists of a block of wood pierced by a conical hole, over the smaller end of which is stretched a membrane. A strip of platinum connected to the middle of the membrane forms one electrode, and a thin strip of metal extending to the middle of the membrane and provided with a platinum point, which rests on the platinum strip, forms the other electrode. The conical cavity forms the mouthpiece.

In view of the repeated assertions that Reis never attempted to transmit speech, or to reproduce the "quality" of sounds, it is interesting to recall, in connection with this old telephone, the very words he used in the lecture at which he exhibited it. He began by saying: "The extraordinary results in the field of telegraphy have probably often raised the question if it might not be possible to transmit speech itself to a distance." And after a lucid discussion of the nature of sound and the theory of vibrations, he went on to say: "As soon, then, as it is possible to produce anywhere and in any manner vibrations whose curves shall be the same as those of any sounds or combination of sounds, we shall receive the same impression as that sound or combination of sounds would have produced. With the above principles as a foundation, I have succeeded in constructing an apparatus with which I am enabled to reproduce the sounds of various instruments, and even, to a certain extent, the human voice. It is very simple, and by means of the figure will be easily understood from the following explanation."

He then gives a drawing of this transmitter, and follows it with a careful description of the entire instrument and the mode of its operation. And then, with his characteristic caution and modesty, he adds: "Hitherto it has not been possible to reproduce human speech with a distinctness sufficient for every one. The consonants are for the most part reproduced pretty distinctly, but the vowels, as yet, not in an equal degree."

Certainly no one can look at this old instrument exhibited by Reis while he uttered these words, and doubt that he intended to transmit articulate speech. And if the results of Prof. Paddock's experiments are truly stated, as little doubt can exist that he succeeded in that attempt. That was his first rude effort in pub-

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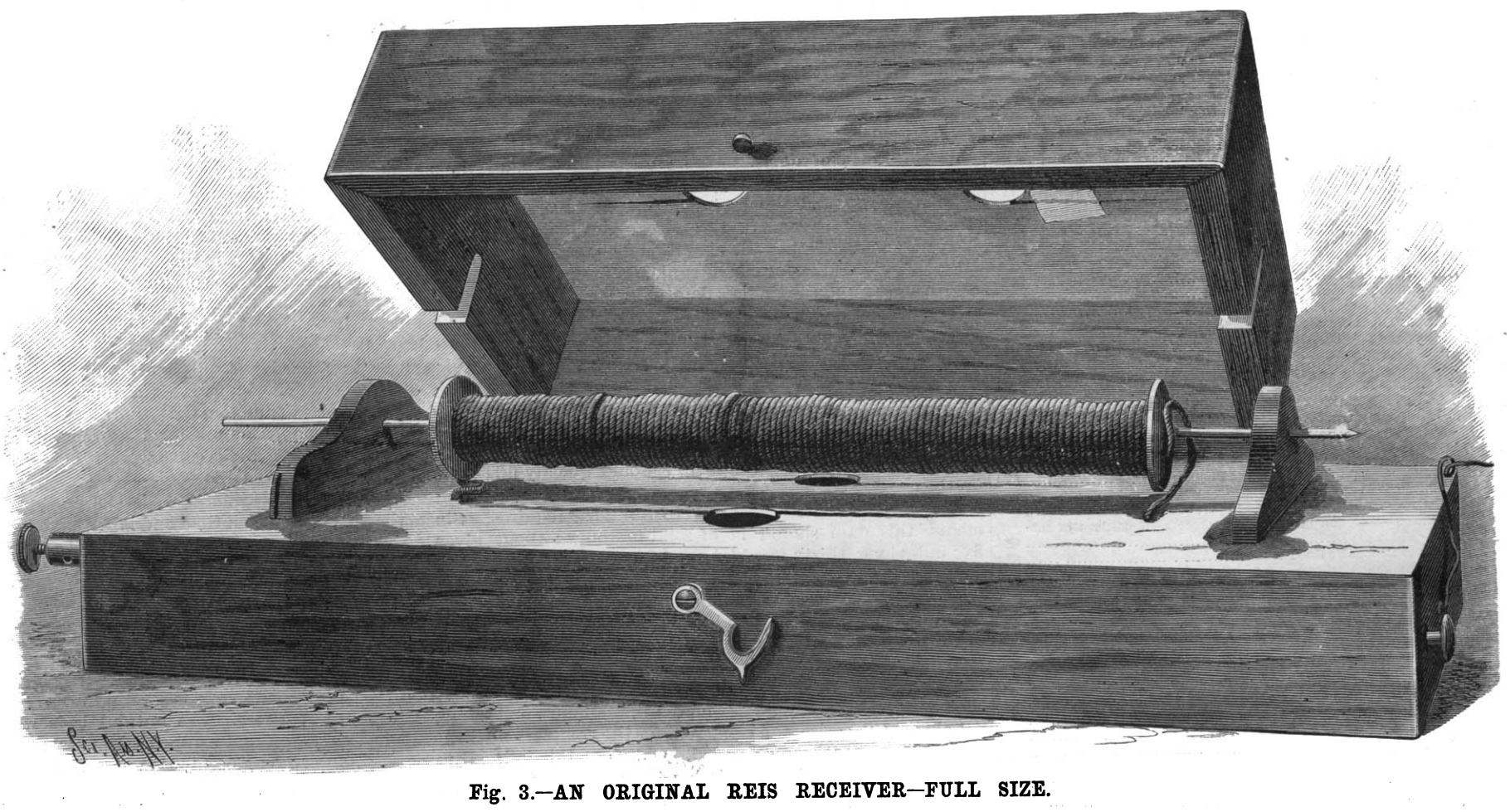
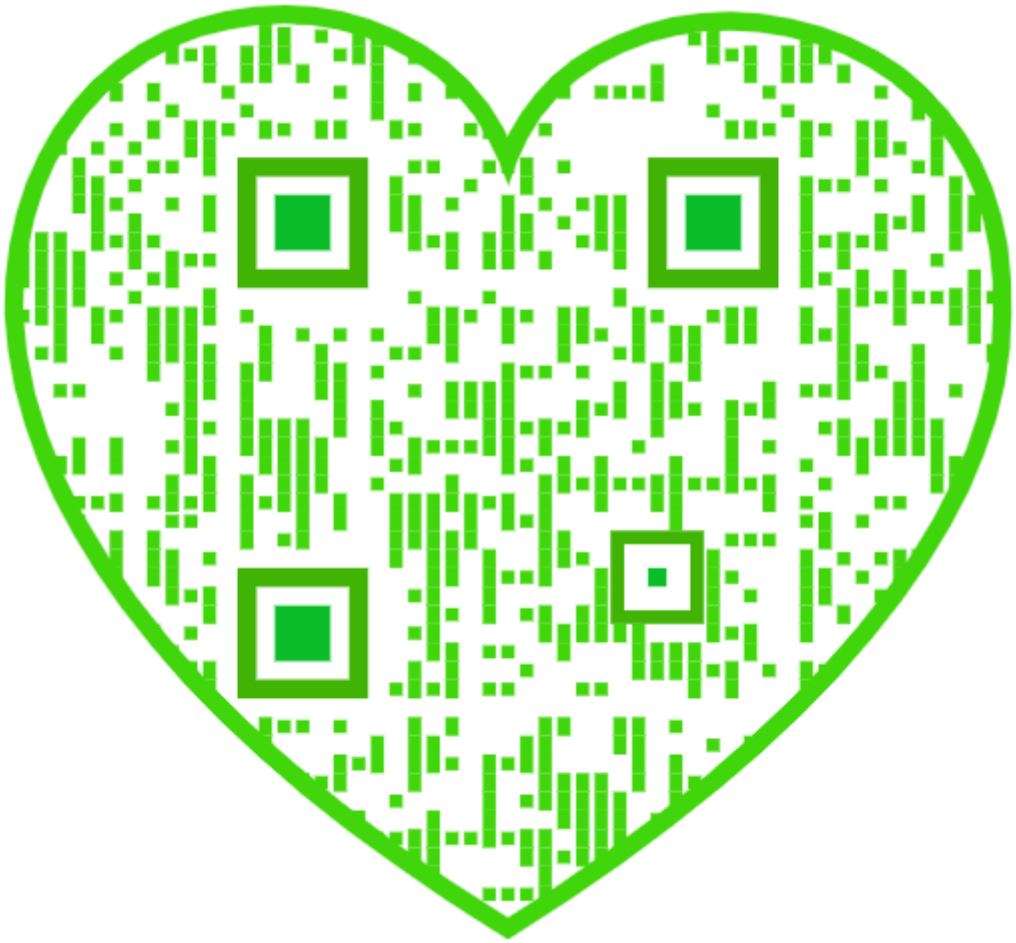


Fig. 3.—AN ORIGINAL REIS RECEIVER—FULL SIZE.

The magnet is composed of a bobbin inclosing a knitting needle, whose ends extend beyond the bobbin, and are received in bridges on the resonant case. The terminals of the bobbin are connected with the electrodes of the transmitter, a battery being placed in the circuit. Sounds uttered in the mouthpiece of the transmitter cause the membrane of the transmitter to vibrate, and so produce changes in the current at the contact of the electrodes. The fluctuations of the current affect the magnet of the receiver, so that sounds are produced in the receiver like those uttered in the transmitter.



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NEW YORK, SATURDAY, NOVEMBER 28, 1885.

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PROGRESS OF THE TELEPHONE LITIGATION.

The first attempt to secure the co-operation of the government in an effort to break down the Bell telephone monopoly having failed by reason of technical irregularity in the proceedings, the Bell adversaries have joined hands for a new effort. The first step in the new departure is to obtain the approval of the Patent Office, which is called upon to say whether there are any facts which show the Bell patent to have been improperly granted, or any reason to suppose that the patentee's claims have a wrongful foundation.

A hearing was lately accorded to all the parties by the Secretary of the Interior, and many affidavits of experts and many long winded arguments were presented for his consideration.

After the hearing, time was allowed for putting in the lawyers' briefs. No decision by the Secretary has yet been made, but it may soon be expected. We have not space to traverse all the evidence; it is sufficient to say that the opponents of the Bell monopoly presented a very strong case, and the Secretary would appear to have good ground to report in favor of a United States trial.

A most interesting portion of the evidence was that contained in Prof. Elisha Gray's affidavit, in which he shows that Bell's success in the electrical transmitting of speech was due to the knowledge he obtained from Gray's caveat, the contents of which were wrongfully made known to Bell by the Patent Office examiner. Gray states substantially that he filed his caveat for a telephone Feb. 14, 1876, the same day that Bell filed his application for a patent for an improvement in "multiple telegraphy," and it is this patent of Bell that has been twisted by the lawyers so it now covers all creation. Prof. Gray says:

In a few days after the issuance of that patent, Bell made an instrument with which he transmitted speech. Long afterward he learned that Bell first transmitted articulate speech through a liquid transmitter, substantially as described in his (Gray's) caveat, and unlike anything described in Bell's application. For a long time he believed that Bell actually invented that instrument independently of his (Gray's) device. He now believes that Prof. Bell, on the contrary, had learned in some way of his caveat and its contents, and that he made use of that knowledge in constructing the instrument with which he first successfully transmitted articulate speech. He (Gray) had supposed that his discovery remained a secret in the Patent Office, as it should have done, and was not known to Mr. Bell. What he now states on the subject is in view of information which satisfied him that Mr. Bell, having obtained his secrets, claimed his discovery as his own, and by this means got the credit of his (Gray's) invention.

IS THE PANAMA ROUTE PRACTICABLE?

The climate and the necessity for a great dam at Gamboa still present serious obstacles to the construction of the Panama interocean canal. The Panama *Star and Herald* is reported as saying: "The successful completion of the canal is considered a mere question of time and money." This seems to be a carefully accurate statement. As for time—we can wait; but it may be doubted if the most patient capitalist, let him wait as long as he will, could get any return for his money, if any such sum is expended as that which it is now estimated a possible canal at this point would cost. The simple statement, "a dam at Gamboa must be built," conveys but an imperfect idea to the casual reader of what is really required. There are different kinds of dams. We have the mill-dam, an obstruction of wood and stone, for the storage of hydraulic energy and the giving of power by increased head; the dam for rendering the river above it navigable by increased depth; the irrigation dam for flooding lands; the coffer dam for raising sunken ships and building bridges; and the tinker's dam, a ridge of putty for stopping the run of molten lead. But the dam required at Gamboa is none of these. It must be large enough and strong enough to stop and hold the mountain torrents and floods while yet on their way down the sides of the declivities. In other words, these torrents must be held suspended above the proposed canal, and safely conducted to other parts. Else they are so fierce and powerful that they would quickly fill up the canal.

It is estimated that, in order to fulfill the requirements, this dam should be of solid masonry; about five miles long, thirty feet high, and fifteen feet broad. The extent of the waters it must hold in check may be estimated from the fact that, in the rainy season, the mountain torrents have been known to flood the valley of the Chagres for many miles to a depth of about sixteen feet.

So far the French company have done little more than scratch a new highway across the Isthmus, and yet almost the entire sum estimated for the completion of the canal has been expended. Only one-thirtieth of the dredging and one-fiftieth of the rock cutting has been done. M. De Lesseps, who is a diplomat rather than an engineer, is now trying to raise another $120,000,000, believing, as he says, that this is all that will be required to finish the canal. Expert engineers, on the other hand, say that $430,000,000 will have to be added to the $120,000,000 originally subscribed, to insure its completion; making $550,000,000 in all.

Via Panama is certainly a tempting route. Look at the map, and you will see that at no place along the narrow strip of land separating North from South America, 1,200 miles in extent, is the distance from ocean to ocean so short as at Panama.

But the map, like the reconnoissance made by Lieut. Lucien N. B. Wyse, of the French Navy, and described to the Canal Congress that met in Paris, May 15, 1879, fails to picture the engineering difficulties and the climate. When these and the estimated cost of a possible canal at this point are considered, the good judgment of the American engineers in condemning it must be clearly apparent.

These men favor Nicaragua as the most practicable route for a canal, but the ship railway scheme of Mr. Eads, by way of Tehuantepec, has gained many friends, and in truth has much to commend it. This scheme, which has been fully illustrated in the SCIENTIFIC AMERICAN, provides for the transportation of ships across the Isthmus by rail; and while those who have not looked into the details might perhaps be inclined to regard it as visionary, it really demands no other mechanical processes than are already in daily use in the shipyard and the drydock. Its originator successfully carried out a scheme for the improvement of the mouths of the Mississippi, notwithstanding the opposition of a large portion of the engineering fraternity, who were inclined to view it as visionary and impracticable.

SUGAR CANE MILLS.

An unusually large plant for crushing sugar cane has lately been constructed at the iron works of Messrs. Deeley & Co., New York. It is expected to be at work crushing the cane on one of the Cuban plantations before the year ends. The three large crushing rolls, 34 inches in diameter and 6½ feet long, are made of cast iron, about six inches in thickness, and weigh, with shaft and gear wheel, nine tons each. Two are placed alongside of each other, and but a short distance apart, while the third is mounted above and between the other two. All these rolls are grooved circumferentially.

A steel knife, supported between the two lower rolls by a wrought iron beam, has one edge almost touching the grooved face of one of the rolls. It is then curved toward the other roll, and serves to guide the bagasse, or extracted cane, through the second opening, while the juice falls into the pan below the rolls. The construction of this knife is a special feature of the Deeley machines, and, it is claimed, prevents any interruption of the work by the jamming of the bagasse between the rolls.

Engines of one hundred horse power are required to drive the rolls. The motion is quite slow, being about 18 feet circumferentially per minute. An inclined platform leads down to the opening between the upper and lower rolls, and is provided with a continuous feeding device which delivers a layer of fresh cane two feet thick. As this opening is only one-eighth of an inch, and the older cane has a toughness almost equal to young pine wood, it will readily be seen that enormously heavy machinery is required to pass the bagasse through so small an opening, and extract the juices with any degree of thoroughness.

As much as 400 tons pressure is exerted between the upper and lower rolls. The king bolts used to lock the machinery together are made of wrought iron, six inches in diameter. Such a plant will treat 50 tons of cane in 10 hours. After treatment, the sirup is conveyed to the evaporators, and the bagasse is submitted to two or three days' drying in the open air, or is taken directly to the furnaces to be consumed as fuel.

The low price of sugar, and the competition from the beet root, have forced upon the manufacturers of cane sugar the necessity of the closest economy, of which these large and carefully built plants are an essential element. The industry is also becoming of commercial importance among the resources of Mexico, and similar but smaller plants for that republic are now under construction at the same works.

SHELL FISHERIES OF CONNECTICUT.

Since the year 1881, much time and labor have been given to the important work of mapping the oyster grounds within the jurisdiction of the State. There are now 772 lots of various sizes and dimensions; and in order to survey them properly, twenty-seven main signal posts were erected, besides many minor ones, and the commissioners' line was run from headland to headland, leaving the bays and estuaries inside that line to the jurisdiction of the several towns lying along the southern shore. The natural beds were then explored, surveyed, and mapped. Maps were finally prepared, known as "occupation maps," making use of a careful system of triangulation, by means of which every oyster lot in the portion of Long Island Sound belonging to Connecticut can be accurately described. The work in this respect is not yet done,

having been interrupted frequently by conflicting claims; but it has made rapid progress during the past year, and it is hoped that the commission may lay their finished map before the public before very long. Meanwhile the "occupation maps" answer nearly every practical purpose.

The entire number of applications for oyster lots filed since June, 1881, is 604; and the whole number of acres granted to the applicants has been, thus far, 45,668 acres, to which should be added the 33,988 acres previously designated by town committees, making the aggregate acreage of submarine farm-lands 79,656 acres, of which 16,202 acres are under actual cultivation. There is also a large area of good ground not yet designated. A considerable portion of what has already been taken up is held for speculation, but the cultivated area is steadily increasing, and might do so with greater rapidity were it not for the present law withholding oyster grounds from non-residents. The price is fixed at $1.10 an acre, which of course is merely nominal, and intended to cover the costs. The State has actually received only a little more than $50,000 from what has thus far been sold. But the taxes, concerning which there has hitherto been such dispute, are now paid without complaint, and this year amount to $7,890, paid by 423 tax payers, of whom 93 own 10 acres apiece, or less than that, 33 own from 11 to 25 acres apiece, 152 own from 26 to 100 acres each, and 145 own each from 105 acres upward, some of the farms being of large size, including from 5,000 to 15,000 acres each. There are ten per cent more oyster growers than there were a year ago; and the fleet of oyster steamers has increased from forty last year to forty-nine this year. The depth of water overlying the oyster grounds varies from ten feet to seventy feet, and much of it could not be cultivated, were it not for the aid of steam power.

WHITE BRONZE.

In our issue of November 14, in the opening paragraph describing this industry it was stated as having been developed during the past two years. We should have said ten years. The industry has now been in successful operation for a decade, and is rapidly growing.

The Canadian Pacific Railway.

The recent completion of the Canadian Pacific Railway, after fourteen years' hard work, marks another chapter in the remarkable engineering history for which America has become famous. Surveys for the road began in 1870, and a vast amount of information respecting the transcontinental route was collected. These were not completed until 1878, when ten million dollars had been expended. The route thus laid out was considerably north of the present line, and opened up a larger area of prairie country. With the accession of Sir John MacDonald to power, the shorter route, crossing the mountains at Kicking Horse Pass, was decided upon. The road was at first a government undertaking, and by the end of 1880 there had been constructed 432 miles of track between Winnipeg and Lake Superior, 213 miles up the Frazer River in British Columbia, and some other smaller portions. The management however, did not prove entirely satisfactory, and in 1881 the enterprise was placed in the hands of the present corporation, which received the magnificent donative of 710 miles of completed road and attached property, $25,000,000 in cash, 25,000,000 acres of land, exemption from taxation and customs on the materials for construction, besides other privileges, and gave in return a pledge to construct, equip, and operate a transcontinental line north of Lake Superior within ten years. A marked jealousy of American capital and fear of American control was manifested in the very beginning of the enterprise, and it was stipulated in the first charter that for six years shares could only be transferred with the consent of the government. Under the new corporation, however, a large amount of the work was done by American contractors, and Mr. W. C. Van Horne, a resident of Milwaukee, was made their general manager. The crossing of the Selkirk range, the second of the mountain barriers, considered the most remarkable engineering work on the line, was accomplished by an American, Major Rogers.

Under this new impetus, the work progressed with unprecedented rapidity. Forty thousand men at one time were employed along the line, and half that number were almost continuously at work. For days together, the average advance would amount to three and three-quarter miles, and between Winnipeg and the Rocky Mountains an average of over two and a half miles was maintained. Old lines were purchased and incorporated into the system. A new line was constructed between Montreal and Toronto, and the communication between Winnipeg and the sea completed by the establishment of a line of steamers on the Great Lakes. On other parts of the line, the work was progressing scarcely less rapidly. In British Columbia, Chinese laborers were pushing eastward, and in Ontario, the wild country on the northern shore of Lake Superior was being penetrated by dint of hard and persistent labor. In May last, the different sections east of the mountains were connected, and a continuous track extended from Quebec to the foot-hills of the Rockies—a grand stretch of twenty-five hundred miles. But a gigantic undertaking in itself still remained before the two oceans were again connected. Three distinct mountain ranges had still to be crossed—the Rocky Mountains proper, the Selkirk range, and the Gold Range. Between the Rockies and the Selkirk the great Columbia River had to be spanned, and again between the Selkirk and Gold range, when its volume was greatly augmented. But all these difficulties and barriers were finally surmounted, and on the 6th of November the last connection was made at the Sushwap Lakes, on the Pacific division. A completed track of 3,100 miles, or about one-eighth of the circumference of the globe, stretches from Quebec to Fort Moody, while 1,500 miles of tributary track adds power to the system.

The road has cost a quarter of a billion of dollars. In 1884, the government made a loan of twenty-two millions of dollars, and the last Parliament advanced eleven millions more, taking land at two dollars an acre in payment. For some years a large revenue will be derived from the sale of land and town sites, but the road cannot probably pay expenses for a long time to come. It penetrates a country which is not only uninhabited for hundreds of miles, but which was absolutely unknown until invaded by the engineer and his gangs of laborers. It must create its own business by building up communities along the line, and opening up the unoccupied prairies to shepherd and farmer. In Ottawa the road passes through a country whose chief commodity is the picturesque, but further west the Red River country gives promise of large industries and permanent development. Already the metropolis of this new interior, Winnipeg, contains 30,000 people, and emulates the growth of St. Paul and Minneapolis. In the mountains the arrival of the railroad will bring new life to the mining industries, and the farmers will find a constantly growing market for their products. It is possible that the route may serve England as a means of communication with her Indian empire. The admission of British Columbia into the Canadian Union has already given it a political importance.

PHOTOGRAPHIC NOTES.

Large Exhibition of Photographs.—Over seven hundred miscellaneous photographs of a great variety of subjects formed the first annual exhibition of the Society of Amateur Photographers of this city, held on the 17th and 18th inst. at the Sloane Building, Broadway and 32d Street; such a large number demonstrating very forcibly the popular interest taken in photography by those who pursue it as an amusement, and as a help in art studies.

Upon the walls were hung beautiful specimens of artistic photographs, comprising landscapes, composition subjects, and marine views. Many excellent instantaneous photographs were noticeable for their perfectness in detail and the excellent skill which must have been used by the maker in the development of the negatives.

Photographs of buildings, animals in various attitudes, portraits, natural objects, such as flowers, microphotographs, of lightning, of steamer life, enlargements from small pictures, interiors, studies in posing, steamers in motion, stereoscopic photographs, window transparencies, lantern slides, and marine architecture simply indicated the wonderful scope and variety of subjects which were covered and the advance which has been made in recent years.

There were twenty-three classes, divided as follows: Landscapes without figures, landscapes with figures, marine (surf), marine (including vessels), architecture, interiors, portraits (not taken under skylight), groups (not taken under skylight), cloud effect, flowers, animals, still life, street views, composition subjects such as expectation and halt, rustic bridge, enlargements, stereoscopic transparencies, lantern slides, photomicrographs, platinotype, and an entire collection.

Diplomas were awarded in each class, and many of the pictures thus favored were noticeable more for their artistic points than any special technical skill. A view of group of children under some trees, entitled "Listening to the Birds," was extremely natural, the expression of the different faces being very apropos to the subject. A composition subject called "Halt!" was of a young lady perched on a bicycle, held upright by the usual bicycle frame, partly concealed in the grass.

A collection of twenty views of architecture, cloud effects, steamers and sailing vessels in motion, street views, and landscapes, all made by a member only eighteen years of age, were remarkably well done, attracting, as they deserved to, considerable attention.

A series of historical views, showing the old arm chairs used by General Grant, the interior of the room in which he died, and the accompanying simple decorations and accessories about the same, the road over which he took his last ride, the spot where he stopped, and the view he obtained looking off from the mountain, were especially interesting as making a complete photographic record of his last days.

Some photographs of Egyptian boats scenes, and old olive trees lent variety to the exhibit, and were finely executed.

The lantern slides were exhibited by the Society's lantern in the evening, and formed an interesting part of the exhibition. The opening night was largely attended by many ladies and gentlemen, and the general sentiment expressed was one of surprise that so many artistic pictures could be shown.

The first exhibition was therefore acknowledged to be quite successful and meritorious; it will doubtless lead to others of still greater merit and usefulness, all of which will tend to elevate the standard of amateur photography.

Toning Baths.—Mr. Frederick A. Jackson, who displayed specimens of fine printing at the N. Y. Amateur Society's exhibition, gives us the following as his method of toning: The solution should be kept one day before use, and before being immersed, the prints should be washed for twenty minutes in five changes of water.

ACETATE BATH.

Chloride of gold	3 grs.
Acetate of soda	70 grs.
Bicarbonate soda	12 grs.
Water	16 oz.

To obtain the best results it is necessary that the bath be decidedly alkaline; and to insure good working it is advised to have at hand (especially if it is a new bath) a bottle containing a saturated solution of bicarbonate of soda. Taking a single print, immerse it in the bath, and note how it works—it is likely to be slow; if unsatisfactory, add three drops of the soda solution, then three more, and so on until it is observed that the toning commences, which should cease in ten or fifteen minutes. If a longer time is required, it would indicate that the bath was not sufficiently alkaline.

Having determined by experiment the proper condition of the bath, successive prints—a few at a time—are toned in batches with certainty of success.

The bath will keep and can be used repeatedly, it only being necessary to strengthen with chloride of gold as it becomes weakened.

In toning, it is necessary to carry it along until the prints acquire a rich purple tint, and this must not be judged by their appearance in the solution, but only when viewed by transmitted light. A properly toned print should show the purple tint, rich and warm, clear through the paper.

After toning, the prints should be washed for ten minutes in three or four changes of water, and then fixed in a hypo solution—one to twelve—with a little ammonia added, for twenty minutes.

For brilliant black and white, brown, and purple tones, the following bath is preferred:

CHLORIDE OF LIME TONING BATH.

Place in a graduate:

Chloride of gold	2 grs.

And add:

Precipitated chalk	20 grs.
Saturated solution chloride of lime	2 drops.
Boiling water	16 oz.

It may be used as soon as cool, but better results are obtained after 10 to 24 hours. In 48 hours its activity is greatly lessened.

The prints are washed in two waters, and removed from the third direct to the toning bath.

Brown Tone.—Keep the print in the bath until it assumes by transmitted light a *crimson lake* color. Two trials may be necessary before the exact tint can be obtained; when it has been reached, the print should be placed in clear water and rinsed thoroughly.

Purple to Black.—Continue the toning until by transmitted light the print presents a decidedly purple color—the finer, lighter portions will then attain a delicate lilac.

Should this tint appear before the shadows assume the darker purple, the print is toned, and should be carried no further.

The shorter the prints are kept in clear water before toning, the better, as with the lime bath they do not bleach much; it is therefore not necessary to print so deep as to thicken the shadows.

If the paper is taken from the printing frame too soon, and is underprinted, clear and cold prints will be obtained resembling an engraving, by adding to the above bath:

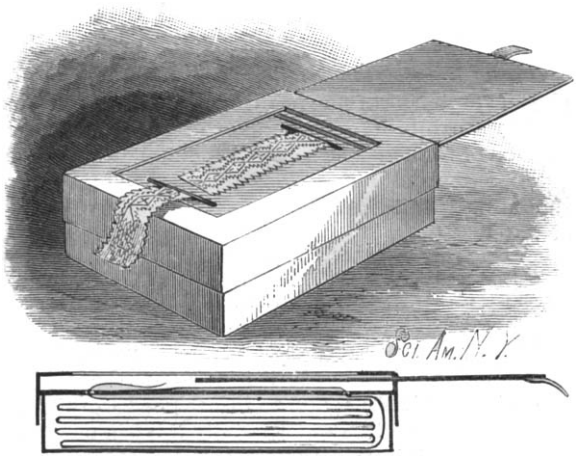
Bichloride of platina, ½ a grain, made neutral with carbonate of soda—for each grain of gold.

The prints thus toned will not be in the least affected or reduced by the fixing bath.

AT the London Inventions Exhibition, gold medals were awarded to the Mason & Hamlin Organ and Piano Co. and to Messrs. Steinway & Sons, for the general excellence of their instrument, and for several inventions of merit. A silver medal was given to Mr. George Gemunder for musical instruments of the violin class and for the best imitations of the old masters; and a bronze medal to the Smith American Organ Company.

IMPROVED SAMPLE BOX.

The box shown in the engraving is for lace, edging, embroidery, etc., and is so constructed as to show a sample of the goods in the box on the cover—the sample not being a separate piece, but a part of the goods. The box cover has a large opening in its top, and is provided with a horizontal partition a short distance below the top, thus forming a compartment between the top of the cover and the partition, as will be understood from the sectional view. The cover is provided with an end slot, through which a slide can be passed. The partition has a transverse slot near each end. One end of the lace in the box is passed through one slot



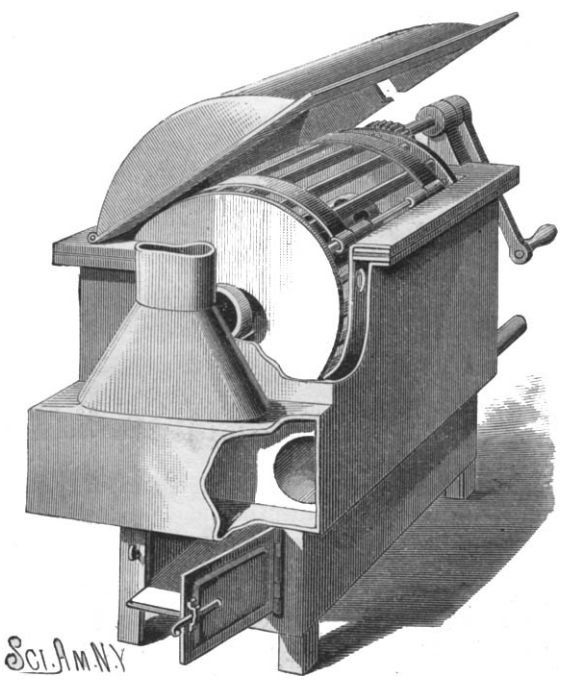
LIEBERTHAL BROS. & CO.'S IMPROVED SAMPLE BOX.

and pasted on top of the partition, and the other end is passed through the other slot and rested on top of the partition; the slide is pushed inward, to cover the partition and ends of the lace. A sample of the contents of the box can be shown by withdrawing the slide. By pulling on the free end of lace, any desired length can be drawn through the opening. The sample and contents of the box are kept clean, while any desired length can be quickly and easily obtained.

This invention has been patented by Messrs. Lieberthal Bros. & Co., of Iron Mountain, Mich., who will furnish further particulars.

WASHING MACHINE.

On the furnace is a metal box or steam generator, the top of which is made semicircular to receive a cylindrical cage constructed of two end pieces connected by bars. The products of combustion pass from the furnace through two flues passed longitudinally through the box at the bottom and into a smoke box connected with the stove pipe. A neck projects downward from the lowest part of the curved top into the cavity of the box, and side apertures are formed near the top edge of the box. The cage has a tubular shaft having numerous openings, and two hollow end trunnions journaled on the inner end of the box, between which inner end walls and outer end walls a steam space is formed. The top edge of the curved top and the outer side walls of the box, and the inner and outer end walls of the



RICHARDSON'S WASHING MACHINE.

box, are securely united at the top, so as to form a tight steam chamber. On one end trunnion is a cog wheel engaging with a wheel on a shaft having a crank handle. A suitable curved cover is hinged to the top of the box. Inverted V-shaped ribs are secured longitudinally on the tubular shaft, and the bars forming the cage are also V-shaped in section.

The water in the generator is converted into steam by the fire in the furnace beneath it and by the hot gases, etc., passing through the flues. The hot water passes up through the neck in the lower part of the space occupied by the cage. The steam issues through the side apertures into the cage, and steam and hot water pass up in the space between the end walls into the tubular shaft, and through the holes to the interior of the cage. A thorough circulation of the hot water is thus kept up in the machine. The cage is revolved by means of the cog wheels, whereby the clothes are thrown about and dipped into the boiling water and raised out of it alternately. The ribs on the shaft assist in throwing the clothes about, while those on the cage act as buckets to raise the water and drop it upon the clothes. The cage is provided with a hinged gate, and the generator has an outlet pipe for drawing off the water.

This invention has been patented by Mr. Wm. H. Richardson, of Mexia, Texas.

Bellows Falls Water Power.

Correspondence to the Springfield (Mass.) *Republican* says the Bellows Falls Canal Company, Bellows Falls, Vermont, has just completed important and expensive repairs, begun some four years ago, to the canal which furnishes power for the large paper mills in that growing town. These improvements are for the purpose of systematizing the use of the water, so that it may be used by those establishments two or three times over, whereas heretofore it has only been used once. By systematic dredging the canal company has secured a fall of 52 feet from level water above the Sullivan Bridge to the still water below the mills. Large head gates have replaced those used about fifty years ago. Nineteen large mills are supplied by this canal, nearly all of which are engaged in the manufacture of paper and wood pulp.

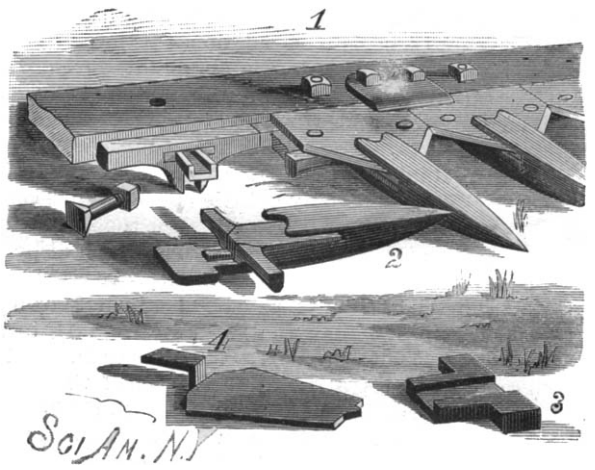
Few people outside of Bellows Falls are aware of the vast amount of paper and pulp produced by these mills. The Fall Mountain Paper Company alone owns and operates thirteen of the nineteen mills, and these use a great part of the wood pulp made there, though a considerable quantity is furnished to Philadelphia, Cleveland, and Cincinnati manufacturers. Much of the manufactured paper is sold to the daily papers. Another thing for which Bellows Falls people are largely indebted to these extensive manufacturers, which gives to the town an additional advantage over larger places in the State, is the electric light, which is furnished the village merchants and others for a mere song, as it were. The Fall Mountain Company furnishes the power for no less than 800 electric lights, 400 or 500 of which are used in the company's different mills, and the balance by the village storekeepers and others, who are charged but one cent an hour for the use of each light, which is of 16 candle power. These lights give such general satisfaction that it seems quite likely that within a few months the plant will be so extended as to furnish many of the village dwellings with a light which it is claimed by those now using it, is cheaper even than kerosene.

The Pyrophore.

At a recent meeting of the Academy of Sciences, at Paris, a plate half filled with water, in which were half a dozen insects about an inch in length, which shone like diamonds, although the room was filled with sunshine, was passed around among the members. These insects had been brought from Mexico, where they are to be found in the forests. Their scientific name is the pyrophore; and, as none had ever been seen before in Europe, they created quite a sensation. The light resembles that of a glow worm or a fire fly, although as much more brilliant and intense as an electric lamp surpasses a wax taper in its power of illumination. When the light begins to fade, it can be made as brilliant as before by shaking the insect, or dipping it in water. It is said the Indians of Mexico use them for a light at night, as a few will suffice to illuminate an entire room. When they are walking at night, they put one on each foot, so that they can be sure of their way, and also that they do not step upon any venomous snake or reptile with which the tropical forests abound. The Mexican ladies buy them of the Indians, and inclose them in a transparent bag, which they wear in their hair or at the neck. The effect is very beautiful, especially when several are worn; and, as the Indians sell them for a few cents a dozen, they are within the reach of every fair one. They are fed on sugar cane, and, if well taken care of, will live a long time. One placed upon a page will enable it to be read with ease in the darkest night.

CUTTING APPARATUS FOR MOWERS AND REAPERS.

The accompanying cuts show a cutting apparatus for mowers and reapers, constructed in such a manner that the wear of the sickle bar can be readily taken up, and the sickles thereby kept in proper position. The stationary cutters can be readily removed, sharpened, and replaced. The fingers are secured to the finger bar in the ordinary way. The sickle bar slides upon the shanks of the fingers in front of the finger bar, and carries the sickles, whose rear ends project a little to the rear of the sickle bar, as shown clearly in Fig. 1. The sickles and sickle bar are held down to their places by keepers attached to the finger bar. Between the shoulders of the fingers and the forward edge of the finger bar are secured plates (shown detached in Fig. 3) whose rear side edges are extended to form flanges, and in whose upper sides are formed grooves to receive the shanks of the stationary cutters, Fig. 4. In the space between the sickle and finger bars is fitted a wear bar, made in sections. In the lower side of the center of each section is a T-groove, the body of which is of such a width as to receive and fit upon the narrow part of the shank of the finger. The arms of the groove fit upon the flanges of the finger shank plate, Fig. 3, so that the sections of the wear bar will be held securely in place when moved back against the finger bar. With this construction, the sections can be easily removed, when



GORE'S CUTTING APPARATUS FOR MOWERS AND REAPERS.

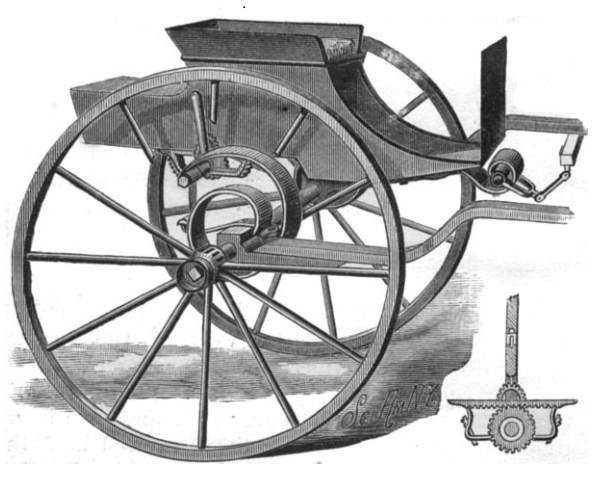
the sickle bar has been detached, by moving them forward to the narrow parts of the shanks of the fingers. Also, when the sickle bar and wear bar wear so that the former becomes loose, the wear can be taken up by inserting a packing of leather or other material between the finger and wear bars. The form of the stationary cutters, which are held firmly in place, and yet can be detached and sharpened or replaced without detaching the fingers, is plainly shown in Fig. 4.

This invention has been patented by Mr. J. M. L. Gore, of Raymond, Kansas.

IMPROVED TWO WHEELED VEHICLE.

The object of an invention recently patented by Mr. Walter C. Bradford, of Germantown, Cal., is to provide an improved cart of a special construction, which is strong and durable, and rides very easily. Secured at each side of the underside of the vehicle body, and some distance behind the axle, is a frame, on the bottom bars of which a shaft rests loosely. On each end of the shaft is a cog wheel engaging with a rack formed on the top piece of the frame, which is shown detached in the small view. Secured on one end of the shaft is a handle bar, carrying a sliding locking bolt, the end of which enters the notches formed between the teeth of a curved rack on top of the frame, or racks on the ends of the frame. The rear ends of coiled steel springs are passed loosely around the shaft, so that the latter is free to turn in the eyes thus formed, and the other ends are clamped to castings on which the vehicle shafts are held; the castings are clamped on the axle. Rubber cushions carried by arms projecting from the castings toward the rear support the body when it swings down too far. Straps connect the ends of these arms with the frames.

By swinging the handle bar toward the rear, the



BRADFORD'S IMPROVED TWO WHEELED VEHICLE.

cog wheels are turned to move the body in that direction, thereby relieving the horse. When more weight is desired, the body is moved to the front and the springs are uncoiled. The bar can be locked in any desired position by the bolt, and the springs held at the required tension. By means of the front spring, which is attached to the front of the body and suitably connected with the crossbar uniting the shafts, the front of the body can be properly adjusted in regard to height. It is apparent that the springs and their attachments can be strongly and durably made, and can be easily and quickly adjusted as required.

THE ST. JOHN STEEL CANTILEVER BRIDGE.

This splendid structure, illustrated by four engravings herewith, has for the first time afforded direct rail connection between the railroads of the State of Maine and the United States in general and those of New Brunswick and Nova Scotia. Previously, communication was broken by a ferry at St. John, N. B., where all freight and passengers had to be transferred to other cars, the ferry not being adapted to the transportation of cars.

The bridge was opened for general traffic on the first day of October, the opening ceremonies taking place September 30. It crosses a natural site for a bridge, if there ever was one which could be called such, and the project has existed in an inchoate state almost from the beginning of railroad construction in the regions concerned; but it has been only recently that the decreasing cost of such structures and the increasing volume of the traffic to be accommodated have made it practically possible.

From its source in northern Maine, the St. John River, flowing first northerly and then easterly, sweeps in a large semicircle around the highlands which form the eastern extremity of the mountain system of Maine, and thence runs southerly to the Bay of Fundy. For some hundred miles above its mouth it is more an arm of the Bay of Fundy than an ordinary river, but almost directly at the mouth of the river, for a few hundred feet only, its current is greatly contracted, to pass through a narrow gateway between two solid ledges which rise abruptly a hundred feet above the water surface, and are now spanned by the structure illustrated. Through this gateway the river passes directly into the bay of the city of St. John, and thence to the Bay of Fundy at a point some forty-five miles east of the international boundary line.

The well known excessive rise and fall of the tide in the Bay of Fundy prevented the adoption of car ferriage, necessitating the complete break referred to in the railroad system at this point, passengers and freight alike having to be transferred.

As will be seen from Fig. 4, the tide rises and falls 22 feet directly under the bridge twice a day, making a current which at certain hours is almost unparalleled in its violence. A cantilever or suspension bridge was therefore the only reasonable type for the locality. A highway suspension bridge just below the site of the new bridge (shown in Fig. 2) has existed for many years, but the choice between the cantilever and suspension types for railroad purposes is no longer doubtful.

The main river bridge consists of a central span of 477 feet, supported on granite piers, which are 9x27½ feet on top, the east pier being about 96 feet high and the west pier about 50 feet. The cantilever arms are 143½ feet on each side of the pier at the east side and 191 feet at the west side, the end of the east arm being supported on masonry abutments placed in an excavation made in the solid rock, and the west arm

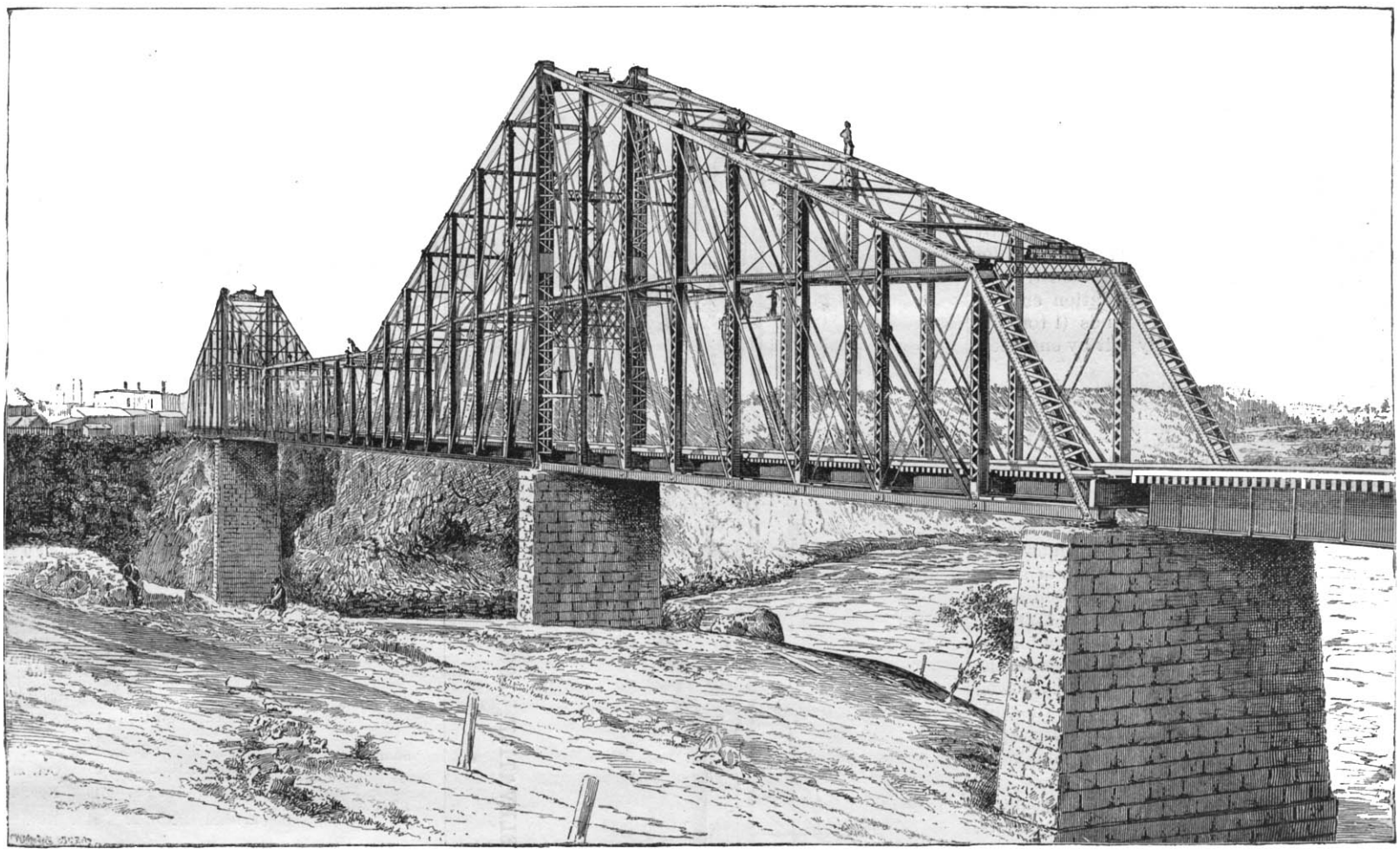


Fig. 1.—STEEL CANTILEVER BRIDGE OVER THE ST. JOHN RIVER, AT ST. JOHN, N. B.—VIEW FROM WEST END.

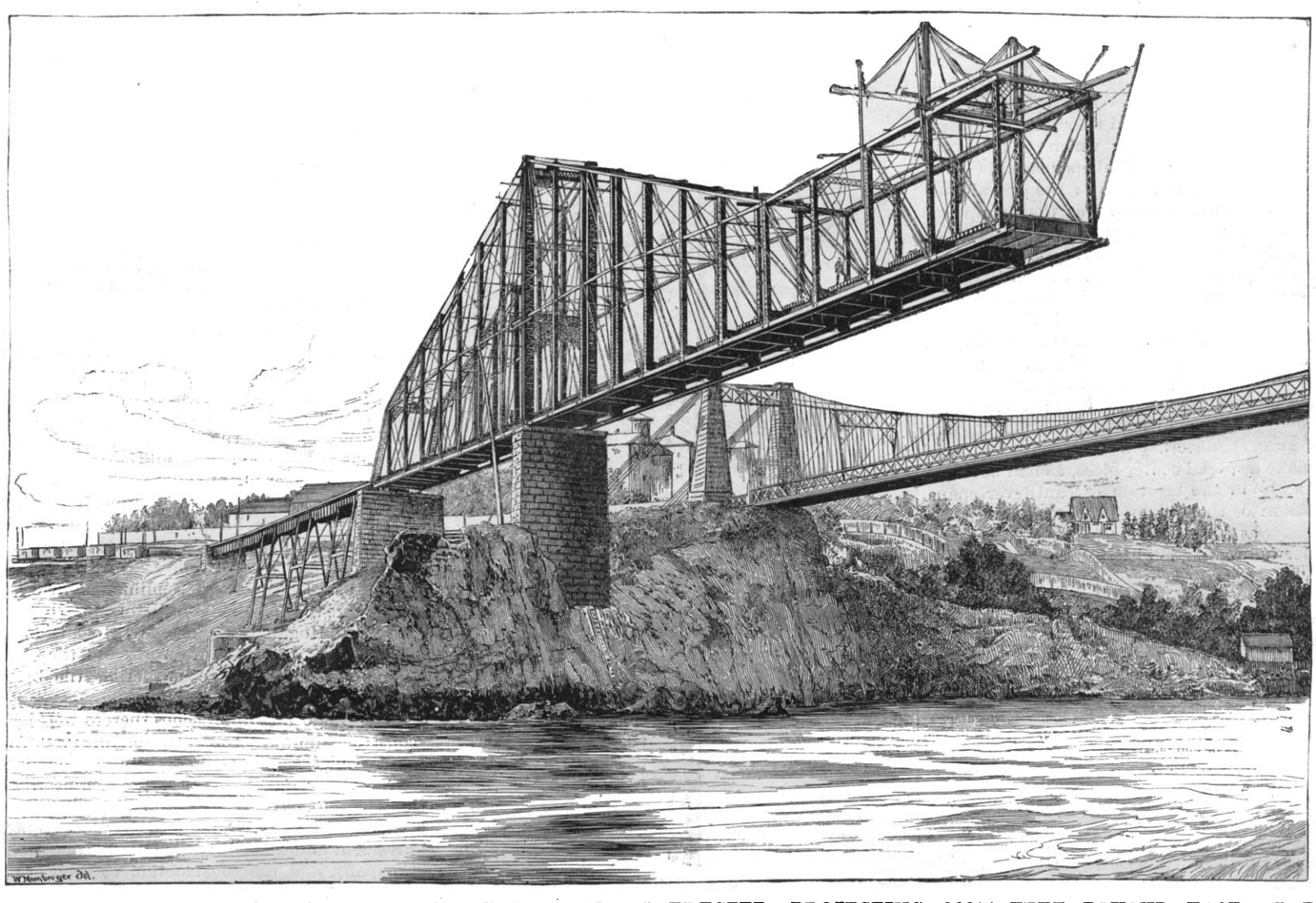


Fig. 2.—WEST SHORE ARM AND HALF OF RIVER SPAN, AS ERECTED, PROJECTING 262½ FEET BEYOND FACE OF PIER.

being supported by a granite pier 8x34 feet at the top and of about 40 feet in height. The central span is 143½ feet, and is essentially an independent truss span, as in other bridges of this type, the ends being supported by the ends of the cantilevers. The depths of the trusses over the piers are respectively 65 and 80 feet, and the short arms at the ends and the center span are each 27 feet in depth. The panel lengths of the trusses are about 24 feet, and the track is supported on the lower chord by means of steel floor beams 3 feet in depth, riveted between the struts and posts, and by four lines of longitudinal stringers 30 inches deep, riveted between the floor beams. Upon these are placed the wooden ties carrying the rails, 8x8 inches in section and 17 feet long, placed 8 inches apart.

The structure is proportioned to sustain a train load of 1¼ net tons to the running foot in connection with two engines weighing 45 tons each and followed by tenders each, with the usual strains per square inch for various parts. [The Niagara cantilever was constructed for a rolling load of two 50 ton consolidation engines followed by a train weighing 2,000 pounds (1 ton) per lineal foot, the latter being generally felt by engineers to be too light.]

The ends of the cantilevers at the abutments are secured by anchor rods to a gridiron of rolled beams placed 27 and 32 feet respectively below the bridge seats at the east and west ends, upon which rests a weight of masonry amounting to about 780 and 880 tons, about three and half times the greatest calculated upward strain with the span on the piers loaded and the shore arms unloaded. The arrangements for allowing expansion and contraction consist of a nest of rollers placed under the shore arms at each abutment, which allow the shore arms to expand and contract by simply swinging the anchor rods round the pin connection in the gridiron of beams beneath the masonry. The expansion in the center span is allowed by slotting the upper and lower chords at the ends of the cantilever arms, and allowing the center span to swing on the vertical post which supports it at the end of the cantilever arm.

The shore arms of the bridge were erected by means of false work placed between the piers and abutments, upon which was placed the lower chord and floor system of the span. Upon this part was erected a movable tower derrick 100 ft. high, 24 ft. long, and 16 ft. wide, running on a temporary track of 14 ft. gauge, which serves as a means of raising the different pieces of the shore arm and holding them in position while being connected, the hoisting of the pieces being effected by means of an engine having eight hoisting winches, which was placed on the track and moved along in connection with the tower derrick. The shore arms having been thus erected and the derrick brought up to the post over the pier, the traveling crane for erecting the river arm, shown in Fig. 3, was raised up and set on top of the pier post, and the tower derrick was taken down and removed. The traveling crane shown in Fig. 3 is 72 ft. in length, the forward portion projecting out over the river 1½ panel lengths, or 36 ft., and the rear arm being secured to the upper chord of the shore arm already erected.

The tackle for raising and supporting the parts constituting one panel of the river arm was suspended from the overhanging crane, and they were connected to form the complete panel, after which the crane was moved forward on temporary timbers placed between the upper chords until it rested on the post already put in position. The next panel was then completed in the same manner, and this process was continued until the center of the river span had been reached.

The same mode of erection was then applied to the opposite side of the bridge, and continued until the two spans joined in the center. The connection between the center span and the cantilever arms was made solid during the process of erection by means of adjusting screws at the lower chord and adjustable stirrups at the upper chord, which were so arranged that the two halves of the center span could be moved in and out for the purpose of making a connection at the center without having to make a special center piece, as had been the previous practice in the erection of cantilever spans; and the location of the masonry and construction of the ironwork was so accurately carried out that the center connection was made without the slightest delay or difficulty.

The chief dimensions of the bridge were in detail as follows: We add for comparison the similar details of the Niagara cantilever bridge, the nearest similar work, which was begun about the same time, but reached completion some eighteen months earlier:

		St. John. ft. in.	Niagara. ft. in.
Length over all, centers of end pins		812 6	910 1½
Length center span		143 6	119 9
Length each cantilever	287 0 / 382 0		395 2½
Length center opening in the clear		477 0	470 0
Height wrought iron towers		.....	130 6½
Height masonry piers		96 and 50	39 0
Length of panels	cantilevers	24 0	25 0
	center girder	24 0	24 0
Width, center to center of trusses		20 0	28 0
Depth cantilev. trusses	over towers	80 and 65	56 0
	over river ends	27 0	26 0
	over shore ends	...	21 0
Depth floor beams		3 0	4 0
Depth longitudinal stringer		2 6	2 6
Ties (white oak) center to center		16 in.	18 in.
Ties, size		8 ft. x 8 in. (x 17 ft.)	9 ft. x 9 in.
Guard timbers			8 ft. x 8 in.
Weight (tons of 2,000 lb.)	steel	....	636·0
	wro'ght iron	....	1,546·3
	cast iron	....	63·2
Timber in floor, M feet B. M		....	153·7

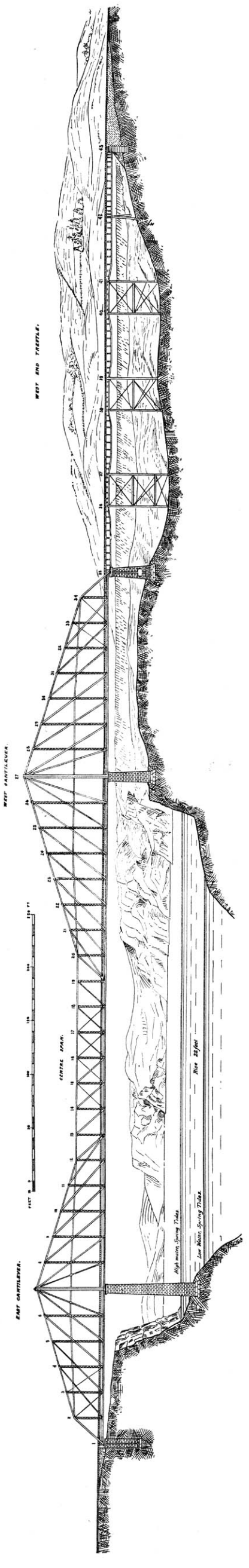


Fig. 4.—STEEL CANTILEVER BRIDGE AT ST. JOHN, N. B.—SIDE ELEVATION, LOOKING DOWN THE RIVER.

In rapidity of erection of ironwork, however, the St. John bridge compares very favorably even with that surprising example of rapid construction, the Niagara cantilever, when the proper allowances are made, notably for the fact that work was prosecuted on both ends at once on the Niagara bridge, but from each side in succession at St. John. Where both records are so remarkably creditable, comparisons would be odious, but those who choose to make them can do so from the following details of the erection records:

ST. JOHN CANTILEVER BRIDGE.

Erection of west shore arm	begun	April 9	
	finished	May 4,*	25 days.
Erection of west river arm	begun	May 9,	5 "
	finished	June 4,	26 "
Erection of east shore arm	begun	June 6,	2 "
	finished	June 21,	15 "
Erection of east river arm	begun	June 24,	3 "
	finished	July 9,	15 "
Total			91 "

First engine crossed July 20, 1885.

NIAGARA CANTILEVER BRIDGE.

		American side.	Days.	Canadian side.	Days.
Erection of towers	begun	Aug. 29		Sept. 10	
	finished	Sept. 8	10	Sept 18	8
Shore arms	begun	Sept. 25	17	Oct. 8.	20
	finished	Oct. 15	20	Oct. 22	14
River arm	begun	Oct. 28	13	Nov. 4	13
	finished	Nov. 22	24	Nov. 22	18
Total			84		73

First engine crossed Nov. 30, 1883.

Whole structure completed and opened Dec. 20, 1883.

The bridge was tested by the government engineers July 31, less than four months after the commencement of the erection, by two trains, each having two engines weighing 60 and 65 tons, followed by loaded flat cars weighing about 30 tons each.

These trains were placed first on the shore arms without any load on the central portion of the structure between the piers, which caused a deflection of one-quarter to three-eighths inch in the center of the shore arms, and an elevation of three-eighths to five-eights inch in the center span.

On the second loading, the four engines were brought together at the center of the center span, and the cars allowed to cover the entire length of the bridge on each side, under which load the deflection was 3¾ inches at the center of the center span, and less than one-eighth inch at the centers of the shore arms.

The third loading was the same as the second, except that the cars on the shore arms were removed, and under this load the greatest deflection at the center of the center span was 4 inches, and the elevations of the centers of the shore arms were one-fourth and seven-eighths inch respectively for the east and west arms.

Every part of the main bridge, including the wind bracing, is made of mild, open-hearth steel. Repeated tests during construction showed its average tensile strength to be about 60,000 pounds per square inch, with an elastic limit of about 36,000 pounds per square inch. The average elongation of specimens before fracture amounted to about 32 per cent, and the reduction in area at the point of fracture amounted to about 43 per cent.

The structure is the first through cantilever bridge that has ever been erected, all the previous structures on the cantilever plan having had the track laid on the upper chord, and hence being much easier to erect than the through bridge. The manner in which the work was executed, both as regards its construction in the shops and its erection at the site, makes a very creditable record for the Dominion Bridge Company, of Montreal, the joint contractors for the work with Mr. M. J. Hogan, of Quebec, Mr. Hogan doing all the masonry and substructure work, and the bridge company furnishing and constructing the bridges and superstructures.

The bridge and approaches thereto were located and constructed under the direction of P. S. Archibald, C.E., Chief Engineer of the Intercolonial Railway, with G. Brown, C.E., as Resident Engineer. The plans for the superstructure of the main river bridge and other ironwork were designed by Job Abbott, C.E., President and Chief Engineer of the Dominion Bridge Company, and the construction of the work was car-

* A week's time was lost in this period by a breakage of the hoisting engine.

ried out under the supervision of W. S. Thompson, superintendent of the company's work at Lachine.

The plans for the erection of the bridge were designed by Phelps Johnson, C.E., of the Toronto works of the bridge company, and the erection of the bridge was done under the supervision of M. H. Hasler, foreman of the bridge company, assisted by F. E. Came, C.E., Resident Engineer.

The total cost of the bridge, we are unofficially informed, says the *Railroad Gazette*, to which paper we are indebted for the foregoing particulars and the accompanying engravings, is not likely to reach a total of more than $550,000, including in that sum the cost of 1¾ miles of connecting railroad between the New Brunswick and the Intercolonial railways, land damages, and all other expenses. About $350,000 of that sum represents the cost of the main structure only, *i. e.*, that shown in Fig. 4. The contract price for the Niagara cantilever bridge was $680,000, which amounts to some 15½ cents per pound of metal (this including, however, cost of all foundations, masonry, and timber), and is generally understood to cover a very handsome and satisfactory profit. The great and rapid change which has taken place in the cost of such large structures as this is evidenced by the fact that only ten years or thereabouts ago the lowest estimates which could be obtained for the structure were $750,000 to $1,000,000, causing its indefinite postponement.

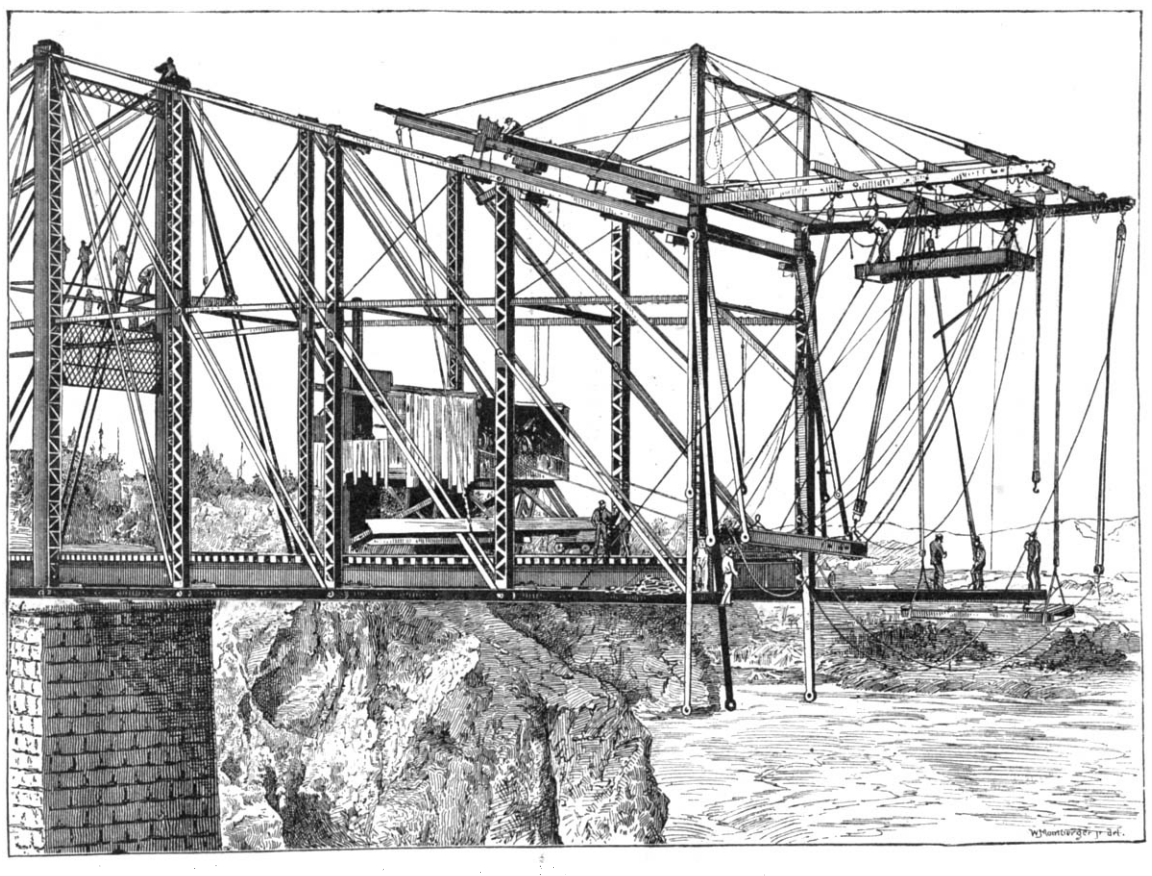


Fig. 3.—STEEL CANTILEVER BRIDGE AT ST. JOHN.—PROCESS OF ERECTION AND PLANT.

The Unexpected.

At the last meeting of the American Society of Mechanical Engineers, Mr. John E. Sweet quoted a number of instances of unexpected results in practical mechanics, and gave them particularly for the encouragement of the inventor, who has so frequently to work in the face of the most unmerciful ridicule. Though the savant is often slow to admit that he has met something, for the time, unexplainable, or that the results of any experiment have been the reverse of what he anticipated, yet the experience of most men of observation is, that there are matters constantly coming up, which defy their powers of explanation, and are the opposite of their expectations.

Every day things, which are perfectly familiar to mechanics of one class, are totally unintelligible to the workers in another branch. Men who have worked a lifetime in fashioning cast iron under the lathe are greatly surprised on learning that the same material, when employed in the heating pipes of a blast furnace stove, grows from six inches to a foot in length from constant use. And the furnace man is equally unprepared to hear that the core bars used for casting pipes lose as much as three inches in casting twenty or thirty pieces. In practice, for instance, we use a piston rod packing of easy fitting Babbitt bushing. When these bushes become sufficiently worn to leak, we close them up by compressing them in the water cylinder of a hydraulic press. In this operation a mandrel somewhat smaller than the piston rod is put inside, and with all the pressure we can bring to bear, we have never been able to compress the bush so as to grasp the mandrel tight, and yet occasionally we have had these bushes shut down while the engine was running so as to grasp the piston rod as if gripped in a vise, to break the bushes asunder, indeed, or to make this necessary in order to get them off.

Again, in the formation of embossed work, two dies are used, the female die often being made by driving the hardened male die into a block of soft steel. This operation is easily performed by a few blows of the drop hammer. It drives in and raises the soft metal without distorting the block in any other particular. Had the same operation been attempted by means of the hydraulic press, the block would probably be upset one-fourth its depth, the sides bulging out or the piece crushed, without producing other than a faint marking of the outline of the male die.

When the lawn mower was first introduced, the inventor was considered little short of a mechanical heretic to imagine that he could get sufficient traction with two light wheels to rotate a cylinder six times their own weight at six times their velocity, and cut the grass in addition. The worm that drives the bed of a Sellers planer does not wear out half as fast as it should, and there is possibly something unexpected about it, even to the makers themselves.

A 12 x 18 inch cylinder engine, which had been running a year at 185 revolutions per minute on an unusually solid foundation, began one day without apparent cause to shake endwise, and before night had shaken itself loose. As no harm resulted, and the work was pressing, the repairing of the foundation was postponed until vacation time, about a month distant. Before that time arrived, however, the shaking ceased, and the engine ran perfectly smooth in spite of the impaired foundation.

Another and even more curious instance of the unexpected was that of a well known electrician who built and tested for three years a certain piece of apparatus, which promised to be extensively used. As it worked perfectly, a large amount of capital was put into buildings and plant for the production of these pieces of apparatus for the market, and many were built, but the manufacturers were totally unable to reproduce the original either in effect or durability.

In another case, two similar boilers were connected by necks at top and bottom, and a fire built under each of them, the boilers being about half full. The water, without apparent cause, behaved very strangely, all going into one boiler and then into the other. When the play was at its height, the boss, considering the lives of the men and the premises of more value than the cause of science, ordered the fires drawn, and the cause could never be determined.

These instances have been taken from practical life, but experience seems to show that scientists are equally liable to be puzzled in just the same way. It is said that Crookes invented the radiometer, and then made it, but to his surprise the action of the instrument was the reverse of what he had anticipated. We might also add the well known case of the Thompson-Houston arc lamp, which is the worst in theory as it is among the best in practice of all the lamps in the market. Even its inventors are unable to give an entirely satisfactory explanation of the action of its mechanism.

Such instances might be quoted almost indefinitely, but we have given enough to show that it is often the part of wisdom to doubt, and that a disputed point, when possible, is best settled by actual experiment. The process of invention is a series of just such discoveries. It is the seizing upon the unexpected, and applying and developing it to meet some need. The transmission of speech by electricity is the basis of a monopoly which represents a value of a hundred million dollars, and yet, but ten years ago, if the possibility of conversing with people fifty miles away had been publicly suggested, it would probably have been denounced as absurd.

Prof. Lesley, in his presidential address at Ann Arbor, stated that the young writer could always be detected by his repeated use of the positive adverbs, while the veteran in science, schooled by experience to acknowledge the universality of error, made frequent use of the modifying clause, and often introduced the element of uncertainty into his statements. The positive up and down assertion is more attractive to one's hearers, but it cannot be denied that there is nothing so sure as the unexpected.

Chemical Composition of the Milk of the Porpoise.

Prof. Purdie, of Scotland, has analyzed a small specimen of milk extracted from the mamma of a porpoise recently caught in the Bay of St. Andrews. It contained:

Water	41·11
Fat	45·80
Albuminoids	11·19
Milk sugar (?)	1.33
Mineral salts	0·57
	100·00

The most remarkable point about the composition of the milk is the large percentage of fat it contains, a constituent of food which, I presume, the cetacean, from its mode of life, would require in larger proportion than ordinary mammals do. The milk was not of an inviting appearance, being of a yellow color and thick consistency, and possessing a "fishy" smell. The specific gravity of the milk, in spite of its solid contents, differed little from that of water.

A Novel Torpedo Boat.

The new torpedo boat David Bushnell, to be used at Ft. Willetts, East River, for laying torpedoes and submarine mines was successfully launched Sept. 26 at the Continental Iron Works, Brooklyn, N. Y., in the presence of a large number of naval officers and engineers. The keel of the vessel, which was designed by Mr. T. F. Rowland, was laid in May. The vessel is of the composite type, and is 85 feet long, 20 feet beam, 9 feet depth of hold, and has a displacement of 300 tons. She is equipped with a pair of inclined engines, the diameter of cylinder being 14 inches, with a 15 inch stroke, which can be run at either high or low pressure. Her boiler, which is of steel, is of the tubular pattern, and is 10 feet long, 8½ feet diameter, capable of carrying 100 pounds of steam. The vessel is fitted with a Mallory propeller, which enables it to turn on its own center. The operations of the vessel are under the absolute control of the pilot, being worked directly from the pilot house. The entire cost is about $35,000. The naval officers present expressed their admiration, and complimented Mr. T. F. Rowland, the builder, Mr. Warren E. Hill, designer of the engine, and Dr. L. A. Smith, who laid the hull.

John Clare.

The death is recorded of Mr. John Clare, of Liverpool, a well known nautical inventor. Deceased was one of the persons who suggested the protection of war vessels by means of iron plates, out of which theory the existing system of iron shipbuilding was developed. On the ground that his suggestions had been practically adopted and carried out by the officials of the Government dockyards, Mr. Clare made a claim upon the Government for a sum of about a million sterling for compensation. The claim was rejected, and the matter was several times brought under the attention of Parliament, but with an unfavorable result. In 1856 Mr. Clare published his correspondence with the Admiralty, under the title of "Mechanical Defects of Things resembling Iron Ships, but constructed upon the Tin-pot Principle." In 1868 he published a work entitled "Life Preserving Ships, hydrodynamically developed upon Metallic Principles, and now forming the National Defenses of Great Britain."

Cotton Items.

In the cotton mills of the United States in 1870, there were employed 134,860 people, men, women, and children combined. The amount paid in wages per head, on an average, was $288.10 for a year's labor; or at the rate of 92 cents per day for 313 days, the number of working days in the year. In 1880 there were employed in the cotton mills 172,544 people, and they received in wages for their year's labor $243.65, or $44.45 less than in 1870, or about 80 cents per day. Now, if we allow for a 20 per cent of a reduction in wages since 1880, it would leave the average wage of each operative 64 cents per day; while the consumption of cotton between the two periods 1870 and 1880 had increased 40 per cent per head.

THE ORIGINAL REIS TELEPHONE.

(*Continued from first page*).

lic, but he afterward made and described other forms which proved much more efficient. Prof. Paddock's testimony shows that during nearly three months of experiments with other forms of Reis instruments, he transmitted speech "with a distinctness sufficient for every one," showing clearly that Reis did in fact invent, use, and describe the speaking telephone many years before Bell, with full knowledge of his writings, took up the subject. In fact, Prof. Paddock and Mr. Smith show in their testimony that with the cubical box transmitter and knitting needle receiver of Reis, they transmitted one sentence containing fifty-six words.

Now, it will be instructive to put in contrast with these facts a brief statement of the substance of Bell's patent, and his own assertions as to his early results. His patent of 1876, which is the foundation of his claim to control the whole system of telephony in this country, does not mention the word telephone, nor allude in any way to articulate speech. It is called a patent for an "improvement in *telegraphy*." He has himself shown that he struck out of the first half of his claim the words "vocal *utterance*," and substituted "vocal and other sounds."

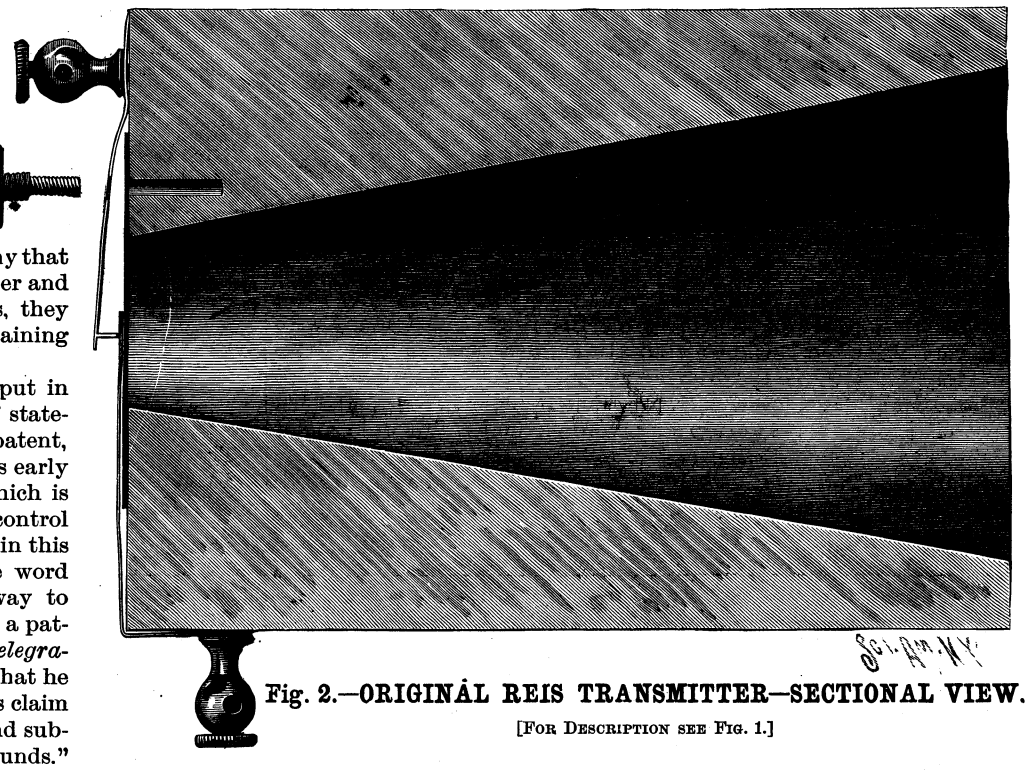


Fig. 2.—ORIGINAL REIS TRANSMITTER—SECTIONAL VIEW.

[FOR DESCRIPTION SEE FIG. 1.]

His fifth claim, upon which the whole Bell monopoly rests, is in these words: "The method of, and apparatus for, transmitting vocal and other sounds telegraphically, as herein described, by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal and other sounds, substantially as set forth."

And the only drawing shown in the patent as the method for producing this result was Fig. 7, which is this:

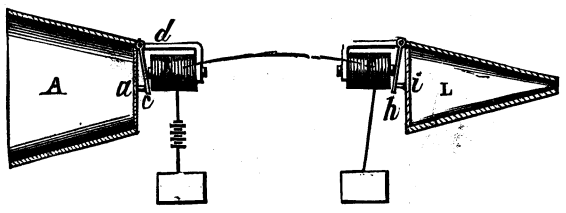


FIG. 7 OF BELL'S PATENT OF MARCH 7, 1876.

c, armature fastened loosely at one end to the uncovered leg, *d*, of the electromagnet, *b*, the other extremity being attached to the center of the stretched membrane, *a*. A, cone for converging sound vibrations upon the membrane. *f*, magnet, *h*, armature, and *i* the membrane of the receiver. When a sound is uttered in the cone, the membrane, *a*, is set in vibration, the armature, *c*, is forced to partake of the motion, and thus electrical undulations are created upon the circuit. These undulations are similar in form to the air vibrations caused by the sound, that is, they are represented graphically by similar curves. The undulatory current passing through the electromagnet, *f*, influences its armature, *h*, to copy the motions of the armature, *c*. A similar sound to that uttered into A is then heard to proceed from L. —*Bell's Specification.*

In the first decision in favor of Bell, in 1881, Judge Lowell said: "Bell *is admitted in this case* to have been the original and first inventor of any mode of transmitting speech." And when Judge Gray followed him in January, 1883, he said: "It *was decided* in the Spencer case, and *is not denied* by the present defendant, that Bell is the first inventor of a speaking telephone." Upon decisions involving these admissions all the later successes of the Bell Company have depended.

If we carefully bear in mind the earliest statements of Reis and Bell, and examine their respective instruments, as given above, and recall a few of the facts now brought out in proof, we may be sure that no future decision will be allowed to rest upon any such admission. We have space only for a bare statement of some of these facts.

1. No model of Bell's Fig. 7 or of any other instrument was filed with his application.

2. No original instrument made by him before his application has ever been produced.

3. He has admitted in his testimony that he never got a word of articulate speech through any instrument before his patent was granted.

4. It is now shown in the recent case before Secretary Lamar that Gray's caveat, filed on the same day with his application, was shown or explained to him against the rules of the office.

5. He admits that the first instrument with which he did get speech contained a liquid transmitter, as suggested by Gray.

6. He says himself that his first efforts with this were "unsatisfactory and discouraging."

7. One of the Centennial instruments, the results of which were so much vaunted, had a liquid transmitter, as suggested by Gray in his caveat, irregularly communicated to Bell.

8. Sir William Thomson, to whom Bell gave one of the other form, in his testimony in the English case on behalf of Bell's British patent, proved that this instrument was inoperative, that he had been unable to make it transmit speech, and that Bell told him at the Centennial that what he had done then was only the "embryo of an invention."

9. There is a great conflict of testimony as to whether Bell's Fig. 7 can even at this day be made to transmit an intelligible word. It certainly will not do so with a distinctness sufficient for *any* one.

10. There is no doubt whatever that it has never been and never can be used as a practical speaking telephone.

11. Bell himself, in his specification for his patent of 1877, describes his patent of 1876 as for "a method of and apparatus for producing *musical tones* by the action of undulatory currents of electricity, whereby a number of *telegraphic signals* can be sent simultaneously over the same circuit."

12. It has been proved by Professors Morton, Brackett, Young, Channing, Barker, Eaton, Paddock, Lyons, Green, and many others, that the modern transmitters in common use are improvements on Reis, and the natural outcome of his published inventions.

13. With the substitution of a carbon for a platinum contact piece, the Reis telephone is a practical commercial instrument. Bell does not claim to have been the first to use carbon contacts in the telephone, and there is no mention of carbon in his patent, nor any room for its use in the devices shown.

In spite of these facts, the Bell Company, fortified by the early Massachusetts decisions, have succeeded in demolishing their opponents in detail, and now claim to control the principle of using electricity for the transmission of speech. It seems eminently just that this enormous claim should now be subjected to a single test, in a suit in the name of the United States, in which all the accumulated knowledge on the subject can be concentrated, and the fullest decision had, before a tribunal to be selected for the public confidence reposed in it. This will be much more satisfactory than to wait until successive cases, each perhaps imperfect, can be reached in the Supreme Court. The people ought to know speedily whether one of the forces of nature, in an application necessary for the purposes of modern life, is the property of a single corporation in this country, notwithstanding the fact that a German inventor gave it freely to mankind a quarter of a century ago, and that in no other country in the world has such a claim been even attempted to be maintained. Indeed, we have only to examine the electrical journals of other countries to see that the whole "undulatory current" theory as a basis for a claim to control the transmission of speech by electricity is regarded as preposterous. They simply wonder at the audacity and skill by which such a claim has been so long maintained in the United States.

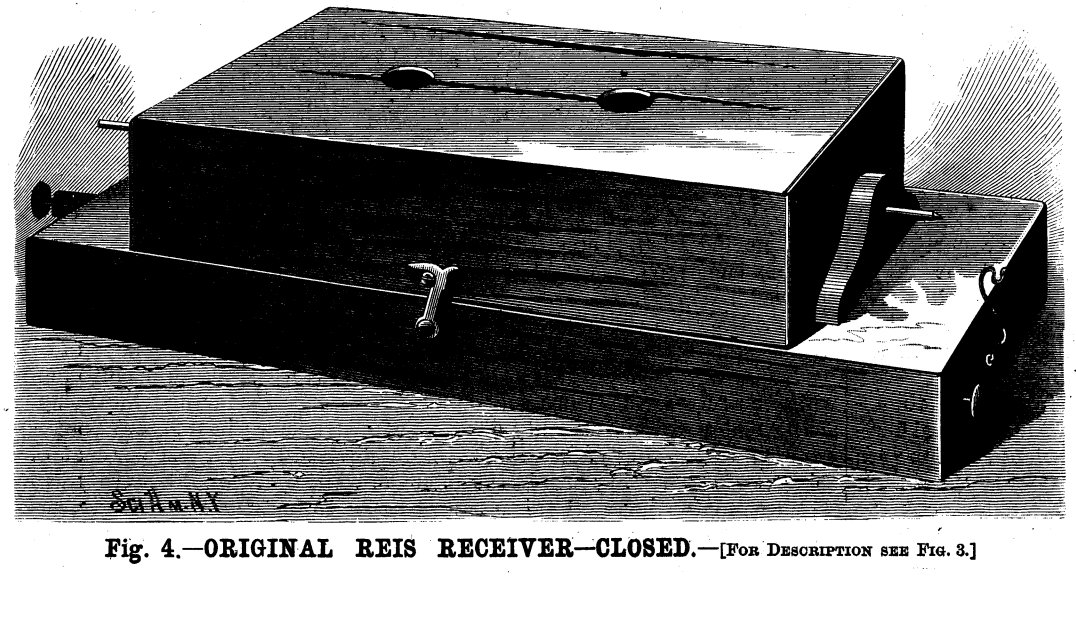


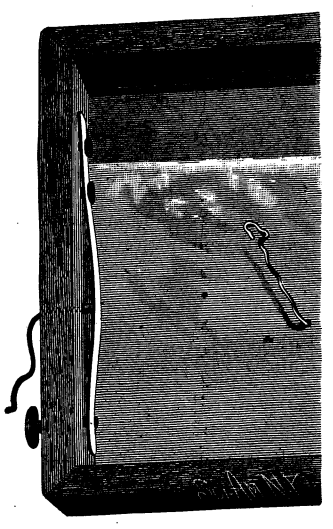
Fig. 4.—ORIGINAL REIS RECEIVER—CLOSED.—[FOR DESCRIPTION SEE FIG. 3.]

Progress of Torpedo Boats.

The construction of torpedo boats is, according to *Engineering*, by no means confined to England. Mr. F. Schichau, of Elbing, lately received an order for twenty-three boats for the German navy, and has recently delivered ten of this number. On their trial trips at Pillau, with the regulation load, they attained a mean speed of 20 knots per hour. Boat No. 10 was subjected to a continuous run of eight hours, and although a sharp wind was blowing the whole time, it averaged a speed of 19·95 knots, a most satisfactory result. These boats are of the same dimensions as those built last year; they have a length of 118 feet, with 16 feet 6 inches beam. In all cases, both boilers and engines worked most satisfactory. One boat will now be turned out each week until the order is completed.

The Chinese navy have, in addition to nine small boats 85 feet long, just placed an order with the same firm for a large torpedo boat, 164 feet long and 20 feet beam, with triple expansion engines to indicate 1,500 horse power. This boat is to run at a speed of from 22 to 23 knots an hour.

Mr. Schichau is also building three torpedo boats for the Russian navy of the same type as those for the German navy. These are to carry coal for steaming, fully equipped, 1,200 miles at an average speed of 10 knots, and are to be capable of making over 19 knots per hour. It will thus be seen that the building of torpedo boats is not the close business it appeared to be some time ago. A few years ago the English Government distributed a few orders among the leading firms here, who, it was supposed, were likely to be successful in this class of work, but the experiment was solely successful in showing that those engineers only who possessed an experience of the subject had a just appreciation of the requirements of the class of vessel.



SIGNAL KEY, REIS RECEIVER.

The American Exposition.

The North, Central, and South American Exposition, more commonly known as the American Exposition, was formally opened at New Orleans on November 10. Only about a third of the exhibits were in place, but it is hoped that everything will be in complete order early in December. The withdrawal of last year's Government exhibit left a large space unoccupied, and fears were entertained that there would be more room than goods; but nearly all of the State exhibits have been so far enlarged that, had more space been available, it could readily have been occupied. Business in the city was suspended on the opening day, and the interest manifested has made the managers confident of success.

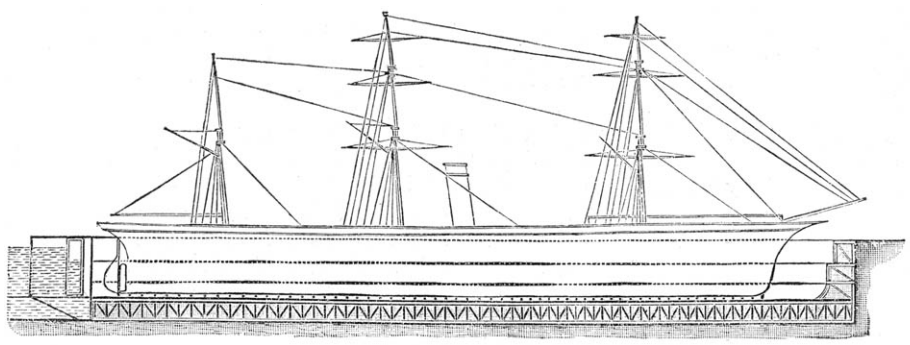
DONALD AND WADDELL'S DRY DOCK.

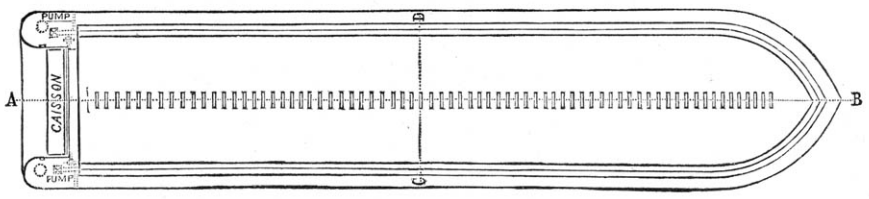
Messrs. Donald and Waddell propose to do away with foundations in the construction of dry docks, so as to permit of establishing the latter at points where the nature of the ground would necessitate a great outlay of money for foundation work, or in countries that are subject to earthquakes.

To this effect they construct the dock in the form of a large, double-sided caisson of metal or wood. Thus constructed, the caisson can be towed or taken under sail to the place that it is to occupy. Here it is ballasted by filling the space between its double sides with ordinary masonry or with beton, so as to sink it to the bed previously prepared for it by dredging and leveling.

These docks are provided with the usual apparatus for emptying and filling. Figs. 1, 2, 3, and 4 represent one of them resting upon the ground, and in service. It is accompanied with a wharf and with a platform upon piles for maneuvering.

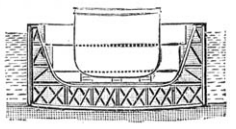
The dock, decked and equipped like a steamer, is capable of proceeding to its destination without other aid. In this case it it driven by helices actuated by separate motors; and the rudder bars traverse the caissons in the stern. These bars are connected with a transverse rod that acts under the impulsion of a toothed sector. When the caisson has reached the place that it is to occupy, it is loaded with masonry again, and the deck and machinery are removed.—*Le Genie de Civil.*





Figs. 1 and 2.—LONGITUDINAL SECTION AND PLAN OF DONALD & WADDELL'S DRY DOCK.

Fig. 3.—TRANSVERSE SECTION.



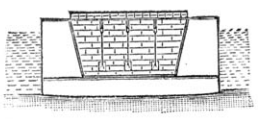


Fig. 4.—SECTION OF CAISSON.

IMPROVED GRINDING MACHINE.

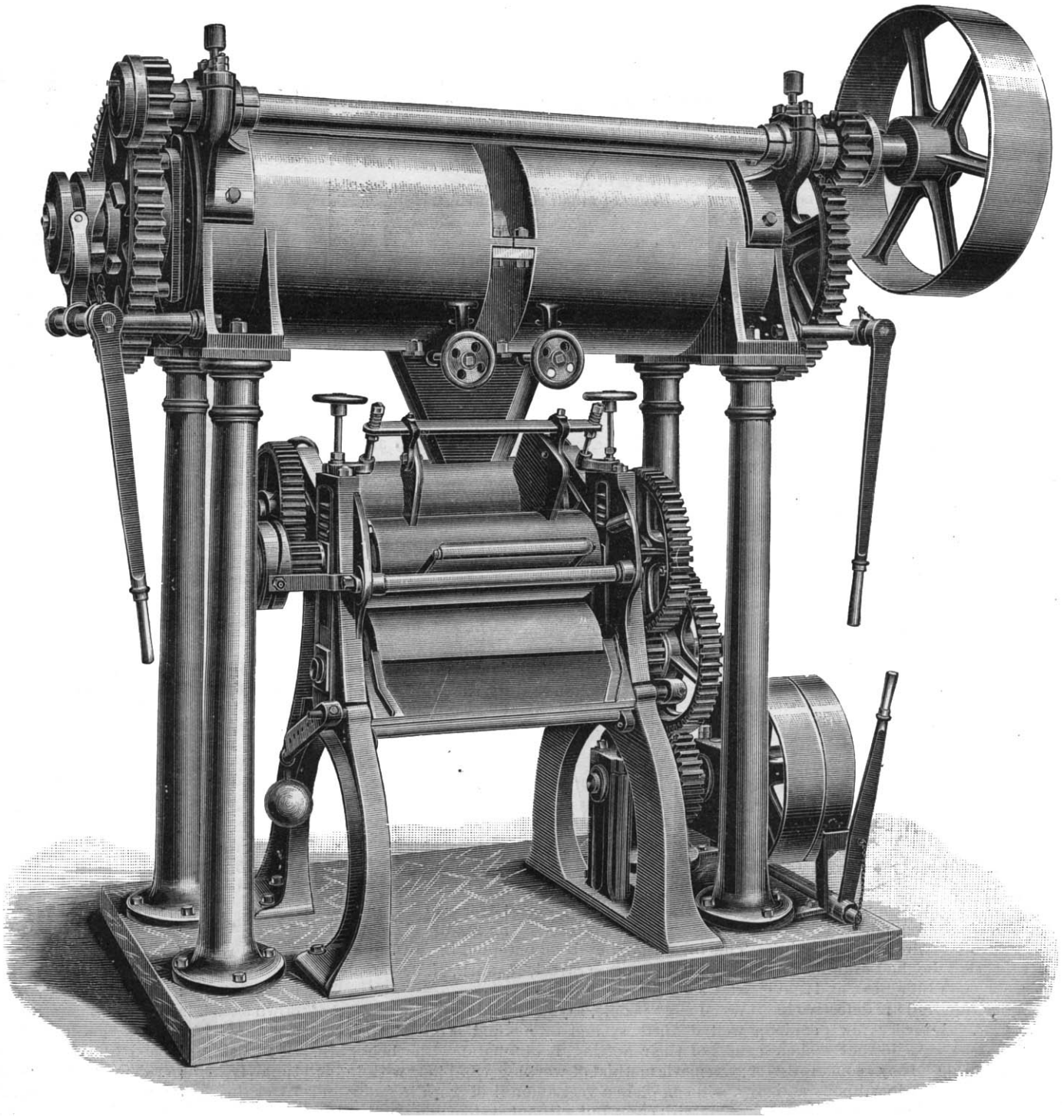
In the machine tool department of the Inventions Exhibition, Messrs. Brinjes & Goodwin, of London, exhibit in operation a new description of paint grinding mill, which we illustrate here, from *Engineering*. As will be seen, this consists of three horizontal rollers which are made of granite. They are placed one above the other. Above these are placed the two feeding hoppers, which also supply the place of the usual mash tubs or pug mills that are used in conjunction with the ordinary paint grinding mills. In these mashers are horizontal shafts having suitable knives mounted on them, corresponding blades being attached to the inside of the vessel. The shaft is worked by spur gearing, and is thrown in and out of gear by the clutch shown in the engraving.

When the machine has to be operated, the dry color and oil are put into the mashers and the shaft arranged revolving. The knives are set with their surfaces at an angle to the axis of the shaft. The pitch of the blades is set so that the material is constantly worked up to the end where the discharge opening is placed. When the grinding rollers are in action, the amount of opening is regulated by a valve and handwheel, as shown; and as the material is propelled forward in the mixer at a much quicker rate than it can be discharged, it constantly falls back to the feed end by its own gravity. There are thus two currents of the materials, one below toward the discharge orifice, and that above from it.

The color and oil having been sufficiently mixed in the mash tub, the valve is opened and the material allowed to fall on to the rollers. The bottom one of these is larger in diameter than the one above it, and the latter has a horizontal reciprocating as well as a rotary motion given to it by means of the cam arrangement, which is clearly shown on the left of the engraving. The pinion of this roller is made with teeth of sufficient length to accommodate this action.

By this reciprocation of the middle roller and the greater diameter of the bottom roller a cross motion is set up, which is far more effective in thoroughly incorporating the paint and oil together than simple pressure between revolving rollers, the result being that an extremely fine paint is produced in a very short space of time.

Springs are fitted so that a pressure may be put on appropriate to the material being ground, and also to guard against damage to the gear should any hard substances be accidentally introduced. The mixers are especially designed for oil paint, but the mill is used for a variety of purposes, such as cocoa grinding, starch making, and printing ink grinding, this design having met with considerable success in the latter industry. The apparatus is shown in operation at the Exhibition.



IMPROVED COLOR GRINDING MACHINE AT THE INVENTIONS EXHIBITION.

A Still Tongue.

An old, experienced Wall Street banker remarked in course of conversation with a reporter on one of our exchanges, a few days ago, that "a still tongue was often a fortune." The idea he wished to convey was that men who talked too much expose the secrets of their business. A silent man is generally the safest adviser; he thinks before he speaks, and weighs well his words. Some men are as ready with their opinions as a hungry man for dinner; all that is required is the opportunity to air them. Others are so voluble they tell all they know about their own business, and their neighbors' as well. Generally, you can take the measure of an inveterate talker, as it's wind and froth. On the other hand, the man who holds his tongue is not easily fathomed. "Still water runs deep," with but little noise and friction, while the shallows foam and fret with constant tumult.

As a rule, the silent man is methodical, painstaking, careful. He weighs his words and pounds accurately. In business he makes no fuss or parade; he transacts it, however, with diligence and prudence. Brag and vanity are twins; together they were born and together they will die.

Conceit and boasting are poor elements in trade; airs put on as soon as a little money is made usually have a chill. Boasting of big profits and a speedy fortune to every listener shows a lack of good sense and sound judgment. Men have been hung on their own testimony, and merchants have failed from too much tongue.

Why should the secrets of the store or counting-room be proclaimed on the street corner? A merchant's knowledge of his business is the safest in his own breast. If he is making money, the fact will disclose itself soon enough, in a solid, substantial way. If you must have a confidant, let it be your wife. She is entitled to it, and is your helpmate.

COCAINE hydrochloride as a local anæsthetic is frequently used for toothache and neuralgia; its effect is of course but temporary.

A Magnetized Umbrella.

Some sensational paragraphs have recently appeared in the press about a fortunate umbrella, whose proclivities, being "magnetic," were detrimental to the decent and correct bearing of the compass or "binnacle" on board a Scotch passenger steamer, the Princess Beatrice, plying from Larne to Stranraer. We mention "fortunate," as the umbrella in question has been purchased from the passenger owning it and forwarded by the captain of the ship to Sir William Thomson, F.R.S., in whose laboratory at Glasgow it will doubtless undergo those pleasing sensations naturally incident to a thorough test and report on its scientific complaint.

The helmsman, on a certain voyage of the above named steamer, noticed that the compass by which he was steering was invariably affected by the near approach of a certain passenger, and finally the "fault" was located in the aforesaid passenger's umbrella, which on subsequent trials was found to be strongly magnetic. As umbrellas are usually made of hard steel, this result is not to be wondered at; but even if not distinctly magnetic, the amount of steel in the umbrella would, on near approach to the compass, certainly affect it. Presuming that that umbrella had at a recent date made the acquaintance of an active dynamo, its normal condition would have been altered into a "magnetic" one, and such a state of things we have witnessed ourselves.

It is well known that the too near approach of iron to magnetic needles affects them more or less, and we call to mind an amusing incident related by Captain Marryat, where a native servant placing a frying pan under the binnacle disturbs the superposed magnetic needle. We have seen the magnet of a Thomson galvanometer seriously affected by the pins in a lady's hair, and have ourselves had to replace steel spectacles by non-metallic ones. Indeed, in ordinary testing with a similar galvanometer, it is usual to remove knives, keys, etc., from one's person before making any tests with so delicate an instrument. It was but recently that the vagaries of a not oversensitive horizontal galvanometer fairly for a time puzzled us; the removal of everything in the shape of iron and steel did not alter the erratic behavior of the needle, our near approach for the purpose of examining the deflection produced the same erratic results, until it seemed that it was almost like personal magnetism; but finally the culprit was found in a round felt hat that we were wearing, but as this was supposed to be all "felt," it at the least seemed strange, although the cause was found in a fine steel ring in the outer edge of the hat to give the rim shape, which was strongly "magnetic," having undoubtedly become so from frequent intercourse with active and powerful dynamos. Instances of these kinds are extremely numerous, and it points to a conclusion that as an aid to correct navigation, it would not be advisable to place an umbrella stand round the "binnacle," or that box which contains the steering compass of a ship.

As a practical result of the behavior of this umbrella, we shall probably hear of the passengers to and from the Isle of Man and other places endeavoring to discover whether they are also blessed with a magnetic umbrella. In addition to the usual instruction, "not to speak to the man at the wheel," we shall not be surprised to see the notice, "Passengers are requested not to poke fun at the compass with their umbrellas."—*Mechanical World.*

A Color Blind Fireman.

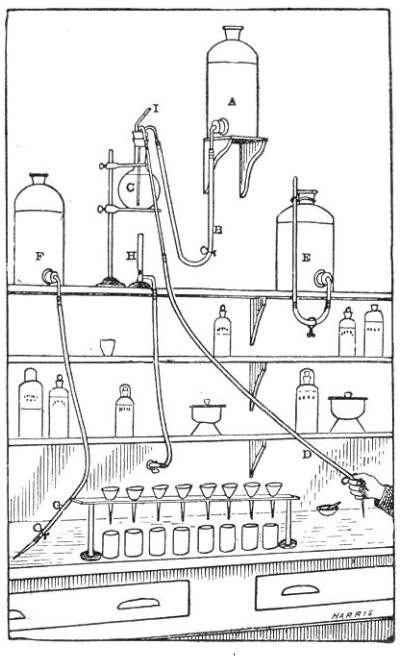
Mr. Julius King, who is the examiner for color blindness for the Lake Shore and Michigan Southern Railroad, has discovered a remarkable case. The patient is an employe of the railroad company. He is a man about 40 years old, and is a fireman. Mr. King made three tests in his case. First, colored glass globes were placed over a gas jet, and the man, at a distance of 20 feet away, asked to tell the colors. He named the red globe correctly when it was first used, but on second trial declared it to be green. Then railway signal flags of different colors were waved before him. He called the red flag green, the green flag red, and when two flags, both red, but of different shades, were waved, the fireman insisted that they were green. Red and green flags held up together he declared to be green. The next test was made with a small rack in which hung zephyr worsted of different colors. The standard color of green was pointed out to the man, and he was asked to select the worsted in the rack of the same color. He immediately picked out bright red, old gold, and light brown bunches. The unfortunate fireman had to be discharged. Mr. King said that he had examined a very large number of men for color blindness, and that about four men in every one hundred are defective in their eyesight in this respect. But very few people are as color blind as the fireman. He said that women were seldom found color blind, as they constantly trained their eyes in selecting colors in ribbons and dry goods, and in discriminating between delicate shades and tints. In answer to a question, Mr. King explained: "The theory of the cause of color blindness is that parts of the retina of the eye respond each to different colors. When any of these parts are deficient, absent, or undeveloped, the person cannot see the color that it belongs to, leaving some other responsive part to act."—*Des Moines Leader.*

AN IMPROVED WASH-BOTTLE FOR CHEMICAL LABORATORIES.

BY H. B. BATTLE, ASSIST. CHEMIST, N. C. AG. EX. STATION, RALEIGH.

By this simple device the washing of precipitates and the cleansing of vessels used in the process of analysis, which before required the use of the ordinary wash-bottle, can now be done with much more facility and in a shorter time.

It consists essentially of a thin glass flask, C, placed about three feet above the level of the working desk, and closed by a three-hole rubber stopper. Through one of the holes issues a rubber tube, D (or glass with rubber connections), descending to the desk and ending in a glass nozzle. Connection is made by a second hole in the stopper with a reservoir bottle, A, placed above the top of the wash-bottle. In the third hole is placed a glass tube bent at an angle to keep out dust. On filling the flask from the reservoir—the flow being stopped by a pinch cock—the water is started by suction from below, and the stream through the nozzle can be regulated or stopped at will by a pinch cock placed conveniently to the hand, the height of the water flask furnishing the pressure, which is sustained by the siphon.



A Bunsen burner, H, is placed underneath the flask, and the water can be heated when it is so desired. Hot water as well as cold can thus be used in treating precipitates. Other solutions can be employed equally as well as water. (See bottle F.)

The advantages of this system are:

1st. The saving of much time and consequent labor attending the use of an ordinary wash-bottle, especially where several analyses are carried on at the same time, the exertions required by the mouth and lungs being thereby avoided.

2d. No air exists in the tube, as in an ordinary wash-bottle, and consequently the full force of the liquid is utilized immediately.

3d. When used with a wash solution of ammonia water, no trouble is experienced with free ammonia, which ordinarily is quite hurtful to the mouth and eyes.

The large bottle, E, with the accompanying tube, shows a convenient arrangement for holding any solution and delivering the same.

A CONVENIENT ARTICLE FOR HOSPITALS AND SICK ROOMS.

The illustration herewith shows an improved form of cover for vessels for use in chambers and sick rooms, the device embracing an easily operated lever attachment, on the top of the cover, in connection with the handle, whereby the cover is made to fit closely on a rubber washer, and thus serve to confine all the bad odors within the vessel. The device is an extremely simple one, inexpensive to make, and adding but slightly to the weight of the cover, and is so made that the latter can at any time be readily cleansed.

This invention has been patented by Mr. Agur Judson, of 111 Commerce Street, Newark, N. J.

WITH most people, says a sensible writer, the want of a well defined system or method is one of the chief causes of their getting behindhand with their work. A systematic method of working, combined with industry, will complete a vast amount of work in a day and finish it with ease; but without system and application, the worker may be in a continual rush, and yet accomplish little.

Sale of the Great Eastern.

The Great Eastern, the largest steamship in the world, was recently sold at public auction in London for £26,200. The career of the rival of Noah's Ark has been very checkered. Her construction began May 1, 1854, and the work of launching her, which lasted from Nov. 3, 1857, to Jan. 31, 1858, cost alone £60,000, hydraulic pressure being employed. Her extreme length is 680 feet; breadth, 82½ feet, and including paddle boxes, 118 feet; height, 58 feet, or 70 feet to the top of bulwarks. She is provided with eight engines, capable of actual work of 11,000 horse power, and has in addition twenty auxiliary engines. She was sold in 1864 for £25,000, and was successfully employed in laying several ocean cables.

On Tidal Theory and Tidal Predictions.

In a paper reprinted from the *Journal of the Franklin Institute*, Mr. E. A. Gieseler, the Superintendent of Construction, Fourth Lighthouse District, has presented a clear mathematical view of the agencies which influence the tides and the local conditions which must have place in tidal predictions. It is now so generally acknowledged that the tides are caused by the difference in the attractions of the sun and moon on those parts of the earth nearest to them, and on their antipodes, that any detail statements concerning the main theory seem entirely superfluous; since, however, the heavenly conditions causing the tides are by no means simple or uniform, but are subject to constant changes, it becomes a matter of some interest to investigate the causes of those variations, and to learn their quantitative effect.

The first cause which suggests itself is the changes in the distance of sun and moon from the earth. The moon's orbit is an ellipse, the earth being at one focus, and during her revolution, therefore, she constantly changes her distance from the earth. This cycle of change, represented by one lunar revolution, occupies a little over twenty-seven days, during which time the moon passes from her greatest distance to her smallest distance, and back again to her greatest distance. In addition to this disturbing influence, the axes of the moon's orbit are not constant, owing to solar attraction, but vary in a period of about nine years.

With the sun the case is reversed, for here it is the earth which changes her distance during her elliptical revolution about the sun, and passes from her least distance in winter to her greatest distance in summer, and back again to her summer position in the period of one year. Another series of variations is due to the relative meridional position of sun and moon; for if both bodies culminate simultaneously to-day, the motion of the moon will carry her 12° east of the sun by to-morrow, and she will consequently culminate 49 minutes after him. A day later, and the distance and time will be doubled, until, after 14¾ days from conjunction, she is 12 hours behind the sun, or in opposition. At the end of about 29½ days, both heavenly bodies once more culminate simultaneously. This period between two successive conjunctions, which is called the synodic month, differs from the moon's sidereal revolution by 2¼ days.

The changes in the declination of the sun and moon offer still another factor in this complicated chain of causation. As the plane of the earth's equator forms an angle of 23° 28′ with the plane of her orbit, or the ecliptic, the sun reaches this declination twice a year, at the summer and winter solstices, while the points of intersection of these great circles give the two periods of no declination, the vernal and autumnal equinoxes. The moon's orbit lies in still a different plane, inclined at an angle of about 5° to the ecliptic. Her declination, accordingly, varies in a period of about 19 years from 18° to 29°, according to the position of the lunar nodes, which is not fixed, but revolves around the earth.

The synchronous influence of these three causes, the changes in the distance of sun and moon from the earth, the changes in their relative meridional position, and the changes in their declinations, furnishes the material for a complicated calculation; for the resulting curve which represents the actual tide is made up of constantly varying elements. When, in addition to these, the local conditions of prevailing winds and coast topography are also taken into consideration, the question of tidal prediction is seen to be a very intricate one. In the second part of his monograph, which relates to tidal prediction, Mr. Gieseler records his observations made at Cape Henlopen, and publishes the details of his system for general application.

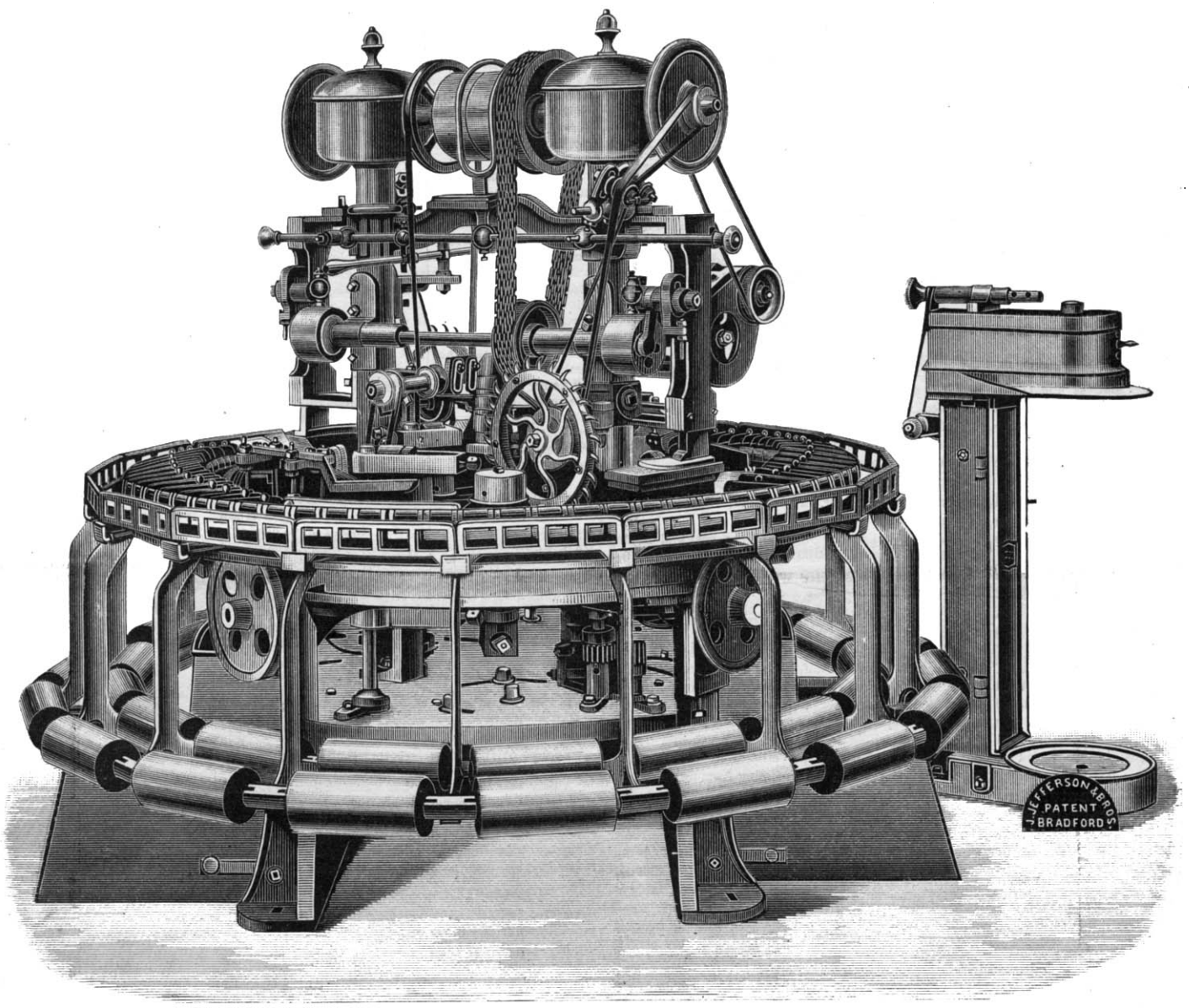
A Horse with More Sense than a Man.

At the recent Horse Show, New York, during the exhibition of the jumpers, the horse of one of the gentleman riders leaped the 5 ft. 8 in. bar, but in coming down struck head first, made a complete somersault, and threw himself on the ground flat on his back; the rider, being pitched ahead, cleared the horse. Fortunately neither rider nor animal was seriously injured. After this most narrow escape the rider again mounted and endeavored to make the horse try the same jump again, but the creature showed more sense than the man by resolutely declining the dangerous job.

IMPROVED "NOBLE" WOOL COMBER.

Wool combing may fairly lay claim to being an ancient industry. Centuries ago it had attained such a degree of importance that those engaged therein thought themselves entitled to the patronage of the saints, and therefore placed themselves under the protection of St. Blaise. History does not inform us whether much benefit accrued from this step to those who followed the occupation, but undoubtedly with the growth of wealth and the increase of population the numbers engaged in it grew in proportion to the requirements of the worsted trade. The simple implements of combing—the combs, fire pan, and the small etceteras—however, continued to be used until within quite recent times, when, owing to the stimulus given to other industries by the introduction of machinery, ideas began to be entertained that it would be beneficial to bring similar appliances into the worsted trade. For several reasons, combing was one of the first branches deemed suitable for the experiment. In 1790 Cartwright succeeded in constructing a practical machine for the combing of wool, but it was deficient in many respects.

Hawksley, of Nottingham, made a considerable advance upon Cartwright's machine, and this was followed at an interval of 35 years by the more successful attempts of Platt and Collier, as these were again distanced in 1842 and 1844 by the further advances accomplished by Donisthorpe. It is, however, to Josue Heilmann, the inventor of the celebrated combing machine known by his name, that the trade is most indebted for the success made in mechanical wool combing. The principle of this machine which has been further developed and improved upon by Messrs. Lister and Donisthorpe and others, rendered mechanical combing such a success that the old system rapidly disappeared before it, and the hand comber in the worsted industry has now become as nearly extinct as the hand loom weaver in the cotton trade. Subsequent inventors have continued the labors of their predecessors in the efforts to perfect this important machine. Among these one of the most successful was the comber of the "Noble" combing machine, which is deservedly the favorite in the trade today. Still even this was not perfect, as improvements continue to be devised to obviate the defects or imperfections that constant use has a tendency to reveal.



IMPROVED "NOBLE" WOOL COMBER.

Among those who have been engaged in this task are Messrs. Joseph Jefferson & Bros., of Bradford, who have been making the "Noble" comb for seventeen years, and whose efforts have been rewarded with considerable success. They have embodied these in their improved "Noble" combing machine, which is illustrated herewith, and the points of which we proceed to describe.

The effects of the older form of the machine seem to have been that through the teeth of the comb being hot there was a tendency of the wool to rise upon or over them when the machine was stopped for a short time, so that when the machine was started, owing to the action of the dabbing brushes being somewhat behind the movement of the comb, the wool or sliver was drawn over the top of the pins, by which a quantity of noil was mixed into the top and spread out into the thread or yarn to an unknown length. The dividers were also late in their action as compared with the combs, which resulted in making slubs in the sliver. Another serious defect was the liability of the dabbing brushes to act simultaneously instead of alternately in their stroke, the result being that when this occurs the machine is severely shaken while this concert of action lasted, causing an excessive amount of wear and tear. In cases where there are a considerable number of machines in a room, and it occurs, that all the dabbing brushes are making their stroke at one time, a severe vibration of the building often ensues. This defect arises from the fact that usually the dabbing brushes are independently driven by separate straps, so that a slight difference in the tightness of these leads to the concurrence of stroke often complained of.

Messrs. Joseph Jefferson & Bros. have obviated these several defects in the following ways: 1. By the introduction of a new motion for driving the dabbing brushes (as shown in the illustration), from which both dabbing brushes are driven by one strap, alternate action being secured by the cranks being set at half centers. This perfectly effects the end in view so far as that point is concerned. But another advantage is also gained by the dabbing brushes starting to operate at full speed before the comb circles are on the move, which never allows the sliver or fiber to pass the center where the two combs come together before it is properly dabbed into the pins of the two circular combs, the result being that the size of the brushes can be reduced so as to cost not much more than half of their former price; and as they descend upon and are lifted from the teeth of the revolving combs more quickly, they are much less exposed to wear from the action of the revolving combs than formerly. This will be obvious to our practical readers. The bad work resulting from the comb commencing its revolution before the dabbing brushes could be got to work, as explained above, has been remedied by an arrangement whereby the dabbing brushes are set to work and acquire full speed before the combs begin to revolve. The same arrangement, or a corresponding one, includes the "dividers," so that all chances of the fibers of the top being doubled back upon themselves are carefully provided against, and slubby work prevented. It will be clear from these statements that, if thought desirable, the speed of the comb can be accelerated and a greater production secured. But, without insisting upon this point, it will be clear that the improvements introduced into the machine have considerably enhanced its value in the matter of producing better work, diminishing wear and tear, and effecting great economy by lessening the quantity of dabbing brushes required.—*Textile Manufacturer.*

GRINDSTONES are made from natural sandstone, the stones being cut into shape and afterward turned.

Wood Screw Heads.

It may be questioned whether the present proportion of bevel, or angle, to the heads of wood screws is the best, and the proportion of diameter between head and shank is the best. A wood screw has a head that is twice the diameter of the shank, and its underside bevel presents a face that is two-thirds the diameter of the shank, or the original wire; thus: diameter of shank, $\frac{3}{16}$ inch; head diameter, $\frac{6}{16}$ inch; bevel of head, $\frac{2}{16}$ inch. Thus the head is very flat or broad in comparison with the shank, or size of the original wire from which the shank is formed.

Nails, which are driven into the wood and hold only by longitudinal friction, have very small heads—in finishing nails, hardly enough to redeem the nail's form from that of an elongated wedge. Screws hold by transverse projections—the thread—and certainly do not need any larger proportional head than do nails. All the heads of screws are "upset" in a heading machine; in some instances, as of short screws, the upset head absorbing one-third of the length of wire cut for the screw. This great spreading of course weakens the tenacity of the metal and tends to "broom" it out. To this weakness, inherent in the unfinished blank, is to be added the slotting of the head for the bit or blade of the screw driver. This cut, always of a generous width, extends in depth almost to the bottom of the beveled head (more than half way, making the head weaker as it goes downward because of the decreasing diameter of the head), in effect nearly splitting the head in two. There are faults in the present construction of wood screws that are apparent on consideration.

Suppose that the proportions of the screw were changed, so that the diameter of the head should be less and its bevel more. For instance, take the foregoing size of screw: shank, $\frac{3}{16}$ inch; diameter of head, $\frac{4}{16}$ inch; bevel of head, $\frac{4}{16}$ inch. This would make a head smaller in extreme diameter but twice as deep as the present style, while the head would be stronger because it was less upset from the original wire size, but the screw driver cut need not be any deeper. The long slant of the bevel of the head would obviate the necessity of a countersink except in very hard woods.

Experiments with Sorghum.

The experiments in the application of diffusion and carbonitation to sorghum cane made at Ottawa, Kan., by the Commissioner of Agriculture have recently been completed. Prof. Wiley, who was in charge of these experiments, says in his preliminary report that the yield of sugar from the cane was more than 99 per cent, only 0·12 of one per cent being left in the waste waters and exhausted chips. The yield of crude sugar, that is, as it comes from the vacuum pan, went as high as 280 pounds per ton, or, at 12 pounds per gallon, 23·3 gallons per ton, a result fully double that obtained by the ordinary methods. The process of carbonitation, the adding of a large excess of lime to the juice, and then precipitating it with carbonic acid, was completely successful. The product obtained was lighter in color and more palatable than that of the usual method hitherto practiced, while the saving in scums is estimated to be at least ten per cent. The difficulties encountered were entirely of a mechanical nature, and easily overcome.

ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Michael Spelman, of Shreveport, La. It is automatic, the drawhead having a device for guiding the link into the cavity to enable it to engage with the coupling pin, and there being a novel link guide and supporter to hold it in the desired positions.

A car coupling has been patented by Mr. Lorenzo D. Hoover, of Rock Island, Ill. The drawhead is formed with a chamber, bridge, and aperture, in combination with a coupling pin having a shoulder and a pivoted leg, the shoulder being adjusted to hold the connecting link upon the bridge, the device being automatic.

An automatic block signal for railways has been patented by Mr. Lewis B. White, of New York city. From standards at the side of the track a novel connection is provided with the rail, so that when the latter is struck by a passing locomotive a crank is operated which sets a signal that will remain set for a given time and then swing back to its normal position.

A boiler furnace has been patented by Mr. John Mailer, of San Francisco, Cal. It has a fuel magazine above and opening into its firebox, with passages leading from the fuel magazine and firebox into a rear combustion chamber, tube lined and apertured doors being provided to admit air to the fuel as it feeds, and the whole construction to facilitate the regular supply and economical consumption of fuel.

MECHANICAL INVENTIONS.

A planer chuck has been patented by Mr. Thomas H. Paul, of Frostburg, Md. A bed piece, with a transversely sliding chuck body, is pivoted to oscillate on the planer platen, and there are other novel features, whereby a gib and gibway may be planed to fit exactly together, or a groove planed in the arc of a circle, or the plane face of a circular segment planed with cuts in arcs of circles.

AGRICULTURAL INVENTIONS.

A fertilizer distributer has been patented by Mr. Joseph Kittle, of East Bend, N. C. It is to facilitate dropping by hand a certain amount of fertilizer, and has devices for measuring and gauging the supply from the hopper, and for sustaining the distributer and adapting it to persons of different heights.

A cultivator for listed corn has been patented by Messrs. John C. McCandless and Orson King, of Randolph, Kan. This invention covers a novel construction and combination of parts in a machine for loosening the soil and destroying the weeds and grass upon the tops and sides of the ridges and between the ridges.

A mowing machine has been patented by Mr. Warren Hill, of Towanda, Pa. It has sleeves on the ends of the axle with downwardly projecting arms connected with the draught pole, and other arms on which a cross bar rests, to help support the frame with the gearing and shafting, to improve center cut mowing machines and prevent undue pressure on the cutter bar, while simplifying the construction.

A cultivator has been patented by Messrs. Lorenzo D. Monroe and George W. Wiggins, of Morgan, Ga. The construction is such that the arms which carry the cultivator blades are made adjustable upon any part of the cultivator beams, and at any angle, while combined with a central cultivator beam are side beams, also carrying adjustable arms and an adjustable draught bar.

A combined cotton seed planter and fertilizer distributer has also been patented by the above named gentlemen. The invention covers a novel construction and arrangement of parts in a machine for doing the furrowing, planting, fertilizing, and covering of the seed at one operation, and doing this expeditiously and with a minimum expenditure of labor.

MISCELLANEOUS INVENTIONS.

A bolt fastener has been patented by Mr. Edward G. Holden, of Oak Ridge, Mo. The bolt has a reduced threaded portion, forming a shoulder and a square offset, in combination with end pieces and toggle levers, to securely hold the bolt in a smooth recess.

An improvement in scissors has been patented by Mr. Theodore Bayrhoffer, of Shelby, Neb. The scissors are made with a pivot plate adapted to a recess in one arm of the scissors, and there is also a spacing plate, so that scissors can always be readily tightened up as desired, and a close joint preserved.

A bodice belt has been patented by Mr. Samuel Bretzfield, of New York city. Combined with a belt having a fastening adjustable for the desired length are two bodice pieces adjustable on the belt, having a loop or pocket for the passage of the belt and a double parallel row of perforations to receive lacings.

A photographic plate box has been patented by Mr. Vincent M. Wilcox, of New York city. It has adjustable and removable corrugated or notched spring partitions to receive the ends or edges of plates and hold them separately, making a case adapted to hold photographic plates of different sizes.

A combined blacking brush and scraper has been patented by Mr. Charles E. Hatch, of Vallejo, Cal. The handle is detachable, and has a scraper or blade for use in cleaning mud or dirt from boots or shoes before blacking, but the handle can be quickly and easily adjusted to the brush again by turning a set screw.

A corset fastening has been patented by Mr. Morris Hertz, of New York city. Its construction is such that the corset is to be hooked about the person in the ordinary way, but when it is to be removed it is only necessary to press downward upon a finger piece, which will operate a plate and hook-shaped keepers to open the corset.

A dumping car and scow has been patented by Mr. William Fallon, of Newburg, N. Y. This invention covers improvements on a former patented invention of the same inventor for the construction of scows and cars in such manner that they can be dumped easily and rapidly, and afterward readily brought back to the normal position.

A sugar cane top and leaf cutter has been patented by Mr. Emilio Lobeck, of Havana, Cuba. The machine has a feed table, along which the cane tops and leaves are passed to feed rollers, which carry them to rapidly working knives, the feed rolls and knives being operated by gearing from an axle of the truck on which they are mounted.

A convertible skate has been patented by Mr. John Lapp, of Honeoye Falls, N. Y. It is intended for both roller and ice skating, and has removable front and rear runners with opposite blades connected to each other, with various novel features, so the advantages of the automatic side curving movements of roller skates may be availed of in ice skates.

A pipe coupling has been patented by Mr. Lucien Lerede, of Paris, France. This invention consists in the employment of metal tubes, each of which has at its ends a ball and socket or other universal joint, with means for rendering it perfectly tight, the device being especially designed for compressed air and vacuum brake apparatus.

A shoe blacking box has been patented by Mr. Francis M. Osborn, of Port Chester, N. Y. This invention relates to blacking boxes in which the blacking to be used is forced through apertures in a plate fitted in the blacking box, and the construction is such that only the quantity of blacking required at a time will be exposed to the brush.

A dissolving key for oxyhydrogen lights has been patented by Mr. Henry J. Brower, of Brooklyn, N. Y. Combined with a key body having separate channels for the oxygen and hydrogen are valve plugs in each channel connected to operate together, the key to be used in turning gas from one jet to one or more other jets, to produce dissolving effects or for other uses.

A flood gate has been patented by Mr. James A. Galloway, of Spring Hill, S. C. Its construction is simple, but it is so designed that the gate may be held open and stopped from revolving, its several parts being held out of the way of timber and other floating objects likely to damage it, and a clear way provided for the water, the invention being an improvement on a former patented invention of the same inventor.

A hand nailing implement has been patented by Messrs. Edward L. Taft, of Gardner, and Henry M. Rich, of Athol, Mass. This invention covers a pair of nail or pin driving pliers, with an automatic nail feeding device, operated by the opening and closing of the pliers, one of the jaws serving to drive the nail and the other as a rest for the rod or article through which the nail or pin is to be driven.

A platform rocker has been patented by Mr. James S. Piper, of Gardner, Mass. The seat back and arm rests are formed of bent wood, the back rest bars extending down below the seat and having their lower ends secured on a curved runner, which has its front bent up to the under side of the seat, then extends along the under side and is bent down to the runner at the rear end of the seat, all on a platform with bent ends forming feet.

An apparatus for dyeing has been patented by Mr. Ludwig Pfaff, of San Francisco, Cal. The fabric to be dyed is wound around a perforated tube, a perforated cylinder surrounding the fabric, and top and bottom pieces covering the ends of the cylinder of fabric, the whole to be placed in a vat, and dyeing liquid forced up through the bottom of the tube, passing through the fabric, and dropping from the apertures of the outer cylinder into the vat.

A water elevator has been patented by Mr. Thomas A. Porter, of Cameron, Texas. Combined with endless chains having novel links and staples are buckets with apertured side flanges through which the staples pass, fastenings passing through the staple in front of the apertured side flanges to hold the buckets in place, and so their open ends, in passing over the drum, will not tip forward until the spouts are carried just above the inner wall of the receiver.

A combined umbrella and cane has been patented by Mr. George Leland, of Jacksonville, Fla. Combined with a hollow cane is a nut adapted to be held on its end, ribs pivoted thereto, with braces and a chain ring holding the lower ends of the braces, the several parts to be held in the hollow of the cane when the umbrella is not in use, the diameter of the cane seven-eighths inch at the smaller end and one and a quarter inches at the thicker end.

A bridle bit has been patented by Mr. Emry Q. Darr, of Shelbyville, Ind. It consists of two rigid bars of different lengths, one above the other, pivoted together centrally, the upper bar suspended by the usual cheek straps, and to remain in a fixed position across the horse's mouth, while the swiveled lower bar turns on its pivot to guide the horse by lines in the usual manner, so that the pull on the rein is not largely expended in drawing on the bridle, but it is transmitted directly to the animal's mouth.

NEW BOOKS AND PUBLICATIONS.

LEHRBUCH DER VERARBEITUNG DER NAPHTHA ODER DES ERDOLES AUF LEUCHT- UND SCHMIEROLE (Handbook of the Manufacture of Illuminating and Lubricating Oils from Naphtha or Petroleum.) By F. A. Rossmassler, Chemist. Vienna, Pesth, Leipzig: A. Hartleben, 1886.

The author gives a systematic account of the crude material, the products derived therefrom, and the gradual progress made in the art of refining. He describes the properties of lubricating and illuminating oils, the different operations of distilling, condensing, purifying, mixing, bleaching, and deodorizing. He sets forth the use of the more volatile products, and describes in detail the methods of manufacturing and purifying lubricating oils, and finally he gives a very full description of the plants for factories and the devices for filling kerosene barrels.

Special.

A BANKER AND HIS FRIENDS.

Alvarado Howard, Esq., is treasurer of the savings bank of Stafford Springs, Conn. Like many other bank men, he had suffered from overwork. There is a sort of headache which is peculiarly the lot of the bank man closely applying himself to business. With it comes a weary and broken down sensation of inability to give full attention to business. All this Mr. Howard suffered, with lack of appetite, loss of flesh, and the other symptoms which with unpleasant plainness tell the story of dyspepsia.

"I was very low spirited," said Mr. Howard to one of our correspondents who visited him at his cozy cottage at Stafford Springs. "My wife was greatly concerned about me. I had taken advice and medicine from the regular physicians, but with very little advantage. Some friends of my wife had taken Compound Oxygen, and had sent her circulars and pamphlets about it. She was much interested in what she read of it, and said she thought this was what I needed. While she was away from home for two or three weeks I sent for a 'Treatment.' You may judge of the effect of the Oxygen on me when I tell you that, although I had not told my wife I had got it, she noticed from the character of the letters I wrote her that I was in better spirits, and consequently in improved health."

"Had the Compound Oxygen, then, so soon begun its good work on you?"

"Yes; it did its work much more quickly than I had any reason to expect. I was surprised, for although I anticipated good results, I had not supposed they would be felt so quickly. Within a week I was so much better that I was going to put the Oxygen away and take no more of it. But I concluded that it would be better to keep on with it for a while. I did so for a few weeks, and was so completely restored to health that I had no further need for any remedy. That was three years ago. Since that I have never been without Compound Oxygen in the house, and I do not intend to be without it at any time."

"Then you have had to resort to it pretty much all the time?"

"By no means; only occasionally, when I have had a cold or something of that kind. But my wife has used it and derived great benefit from it, and so have the children.

"I believe my wife would have been dead but for Compound Oxygen. Her lungs troubled her. The pain was very severe, particularly in the left lung. The symptoms were those of incipient consumption. Both last winter and winter before she took Compound Oxygen through nearly all the cold weather, and with the most remarkable effect. It strengthened her, removed the lung pain, and generally and particularly built up her health.

"As for the children, my boy is eight years old. He has grown up quickly, and is half a head taller than most other boys of his age. He has taken Compound Oxygen for colds and as a tonic and strengthener. Nothing has ever served him better. We have the utmost confidence in it for him. Baby is six months old, and has learned to inhale like a grown person. She had a cold with catarrhal symptoms, and was entirely relieved and cured with Compound Oxygen. I may add that I myself am naturally disposed to catarrh. Since I have used this Oxygen, which is now about three years, the catarrhal troubles have not annoyed me.

"Three or four weeks ago I was suddenly taken down with quinsy. Compound Oxygen had done so much for me in other respects that I tried it for this. I took it pretty hot, putting the tube well down my throat so as to reach the sore and swollen parts. Almost at once it brought down the swelling, and took away the pain. Do you wonder that I so thoroughly believe in such a remedy?"

"I think you said you had friends who had used it, Mr. Howard? Has their success with it been as great as yours?"

"Yes; so completely satisfactory that I recommend it to every friend that I have.

"A lady who was with us, but who now lives in Boston, was troubled with severe colds. My wife urged her to use Compound Oxygen. 'It is all folly,' she replied. 'When one of my hard colds takes hold of me, I must let it run and take its course.' But the Oxygen broke up in three days as severe a cold as she had ever been taken with.

"My sister who lives in New Haven, a married lady, some twenty-four years ago strained her voice and injured her lungs and throat, the injury resulting in chronic bronchitis. For about three years she has used Compound Oxygen, which has kept her alive, for she was very near dying. That she should be entirely cured of such a deep-seated and protracted malady would be too much to expect. But she has been greatly relieved, and her life made incomparably more comfortable than it otherwise could have been.

"A young lady, a friend of ours, living a few miles out of town, has for a long time been troubled with lung disease. The doctor said her left lung was badly diseased, and it was only a question of time when she must die. Her digestive and other functions were much deranged. Both she and her sister were prejudiced against the use of Compound Oxygen, and the only way that I could induce them to consent to the use of it was to send for a 'Treatment,' and assure them that if it did no good in three or four weeks I would stand the expense of it. A week after she began to use it she said that she never had tried anything which had done her so much good.

"She has now improved wonderfully, though of course not yet entirely cured, but oh, how different from what she was!

"Mr. M. C. Kinney, our Town Clerk of Stafford, had two or three attacks of asthma. The old-school physician who had treated him of course condemned Compound Oxygen, and said it was no better than so much warm water. Mr. Kinney took the Oxygen, however, and was greatly relieved."

"Well, Mr. Howard, you really seem to have become a sort of an apostle of Compound Oxygen to all your friends and neighbors. It it not so?"

"Call it what you choose. I believe in this thing with all my heart. Whatever it is made of I don't pretend to know. I know only what it has accomplished for me and my friends, and therefore I freely advise those who are sick to use it. And I have seen its benefit in relieving those who were too far gone for entire recovery. It cannot be expected to work miracles; but even to relieve those who must die is a great achievement for it. Here, for instance, is the case of a young lady who was taken with a severe throat difficulty, which settled on her lungs and ran into consumption. I had some Compound Oxygen in the house, and I placed it at her disposal. This was too late to save her, for she was by this time very far gone. She lived for a few weeks, but during those weeks she experienced great relief. The family wished that they had known of the Compound Oxygen, and had used it, long before.

"Another—a gentleman and his wife who are now in California. The lady had a cankered sore throat and a bad cough. The doctors said she was drifting into consumption. Her husband disliked to displease the medical man by trying a remedy contrary to his advice, but I asked him which he would rather do—please the doctor and bury his wife, or save his wife and confound the doctor. He finally sent for a 'Treatment.' His wife tried it, and her sore throat soon got well. She began to gain in her general strength and health. They had made their arrangements to go to California, and soon after went there. I have since heard from them. The lady is now strong and hearty, with her health entirely restored.

"A young lady who is a neighbor of ours was for years in such a low state of health that she could not half enjoy her life. She had been under medical attendance in a chronic sort of a way, which gave her little or no benefit. We gave her circulars about Compound Oxygen. She received them courteously, but said she was already under medical treatment, and did not want to make a change. One day she came to our house with such evidently improved health that we at once asked her what she had been doing. 'You needn't say anything about it,' said she, 'but I have been taking Compound Oxygen.' I could tell you a long story about her improvement, but suffice it to say that we are all surprised to see how she has gained. She had been able to take but little exercise. If she was going a quarter of a mile, she would order the carriage. She now takes exercise like other people, and although slender and by no means robust in appearance, is in the enjoyment of such good health that she no longer has occasion for the services of the doctor."

Mr. Howard added that he could give instances of other friends for whom Compound Oxygen had performed similar benefits. It will be seen from the record of those he has given that the benefits of Compound Oxygen cover a very wide range of suffering, and are applicable under the most diverse circumstances. Whatever the difficulty, nobody need despair of finding relief by means of Compound Oxygen. To learn more about it send for the pamphlet treatise on the subject, which will freely be mailed to all who address Drs. STARKEY & PALEN, 1529 Arch Street, Philadelphia.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

All Books and App. cheap. School Electricity, N. Y.

Applegate (burglar) Invis. Elect. Mats. 1512 Chest., Phila.

Curtis Steam Trap for condensation of steam pipes, high or low pressure. Curtis Regulator Works, Boston, Mass.

For Sale.—A patent on Window Shade Roller Hangers. Address F. G. Gollon, Hoboken, N. J.

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Geo. E. Lloyd & Co., Electrotype and Stereotype Machinery, Folding Machines, etc. Send for catalogue. Chicago, Ill.

THE EDISON COMPANY FOR ISOLATED LIGHTING,
65 FIFTH AVENUE, NEW YORK, Nov. 14, 1885.
CHAS. A. SCHIEREN & Co.,
Manufacturers of Leather Belting,
Ferry and Cliff Sts., New York city.

Gentlemen:—
We have used several of your special Electric Light Belts. They are very pliable, they do not rip, and do not stretch. They have given us excellent service wherever used. Yours truly,
J. H. VAIL,
Gen'l Supt.

Notice to Manufacturers or Inventors.—A company with a large foundry, iron and woodworking machine shop in running order, located in one of the best towns in Ohio, not troubled with strikes, where coal, wood, and iron are cheap, would take any article made of iron or wood to make during the winter months, which is their dullest season of the year. Stoves or stove castings preferred. Address H. B. J., Look Box 221, Columbus, O.

Estimates given and contracts taken for the construction of intricate mechanical instruments, fine tools, models, and light machinery. Burckhardt & Schneider, 211 Mulberry Street, Newark, N. J.

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The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Coiled Wire Belting takes place of all round belting. Cheap; durable. C. W. Belting Co., 93 Cliff St., N. Y.

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Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

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Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Wanted.—Patented articles or machinery to manufacture and introduce. Lexington Mfg. Co., Lexington, Ky.

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Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

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Keystone Steam Driller for all kinds of artesian wells. Keystone Driller Co., Limited, Box 32, Fallston, Pa.

Iron and Steel Wire, Wire Rope, Wire Rope Tramways. Trenton Iron Company, Trenton, N. J.

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Star—V.V.L.A.R.—R.O.—S.O.R.—C.O.G.—M.R.—F. F.D.—E.W.—William Rose—Batesville—December 22, 1857.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Emerson's ☞ Book of Saws free. Reduced prices for 1885. 50,000 Sawyers and Lumbermen. Address Emerson, Smith & Co., Limited, Beaver Falls, Pa.

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Barrel, Keg, Hogshead, Stave Mach'y. See adv. p. 76.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Rubber Hose, Linen Hose, Rubber Sheet Packing, Empire Gum Core, and all other packings. Greene, Tweed & Co., New York.

Providence Steam Engine Co., Providence, R. I., are *sole builders* of the "Improved Greene Engine."

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) D. D.—The recovery of tin from tin scrap is practiced by several chemical manufactories in and around New York, but not in the metallic state. The tin may be burned and thoroughly oxidized by fire with a free circulation of air. Then treat the oxides with sulphuric acid, which unites with the iron, forming sulphate of iron, which may be decanted and crystallized and converted into rouge, or the red oxide of iron, while the remaining tin sediment may be further oxidized and made into polishing powder, or, as by some chemists, made into sulphomuriate of tin, as used by dyers. It requires some chemical knowledge to carry on the recovery of tin scrap to profit, as well as an abundance of scrap.

(2) W. P. M.—Galvanized iron chain pumps do not affect the water perceptibly for drinking or cooking purposes. They are largely used in wells and cisterns.

(3) J. I. V. D. asks the formula and apparatus necessary for etching pocket cutlery. A. Write with a chloride of gold solution. 2. A brown ink for writing on polished steel. A. We would suggest the following as giving you a colored ink: sulphate of copper 1 ounce, sal ammoniac ½ ounce, pulverize separately, adding a little vermilion to color it, and mix with 1½ ounces vinegar. Rub the steel with soft soap, and write with a clean hard pen without a slit, dipping in the mixture. To produce a bronze color, it would be necessary to first use a black ink, and subsequently coat with bronze powder.

(4) B. P. T. asks: 1. What material is used to bleach skeletons? A. See "Preparation of Skeletons for Museum Purposes" in SCIENTIFIC AMERICAN SUPPLEMENT, No. 106. 2. What are the "green soaps" made of which are used in skin diseases, and who manufacture them? A. Green soaps are prepared from potassa and fixed oils. They are officinal, and therefore can be procured from any druggist. 3. What is the mucilage used on the back of postage stamps made of? A. Gum dextrine 2 parts, acetic acid 1 part, water 5 parts. Dissolve in a water bath, and add alcohol 1 part.

(5) C. P. asks what is the commercial hydrocarbon gas black, and how is it made? A. The preparation of gas black is probably similar to that of lamp black, and is therefore produced by burning ordinary illuminating gas in a supply of air which will be insufficient to completely oxidize it. The black fumes arising from this combustion deposit the carbon on cloths or, in some instances, on metallic plates suspended in order to receive it. Gas carbon, which is possibly what you refer to, may be obtained by passing olefiant gas through a red hot porcelain tube.

(6) H. R. H. asks (1) for a practical recipe for the generation of oxygen gas, for the purpose of inhalation. A. See "How to Make Oxygen," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 313. 2. What effect would the inhalation of sulphur fumes have on the system? A. The inhalation of sulphur has been recommended for the curing of contagious throat diseases, such as diphtheria, etc. The fumes are suffocating, and care must be taken in their inhalation.

(7) E. H. F.—Tonics or washes to make the hair grow can always be employed with greater or less success so long as there is any vitality left in the hair roots. If, however, these are destroyed or entirely dead, there is no possibility of producing a new growth of hair. The following is a well known tonic: Scald black tea 2 ounces with 1 gallon of boiling water, strain, and add 3 ounces glycerine, tincture cantharides ½ ounce, bay rum 1 quart. Mix well, and perfume.

(8) J. W. E. A. asks whether an analysis has ever been made of any of the petrifying lakes or wells in Europe or elsewhere, with a view to discover the petrifying properties of the water, and, if so, what was the result? A. Calcium carbonate, which is insoluble in pure water, but soluble in water containing carbonic acid, is frequently found in springs of carbonated waters which pass through limestone. Objects placed in such waters are coated with a deposition of the carbonate of lime. Travertine is the name given to such formations. Silica is likewise dissolved by certain mineral waters, and the deposits obtained by the evaporation of such waters are known as *silicious sinter*. Works on geology fully describe the process. 2. What chemical or combination of chemicals, apart from those ordinarily used in refrigeration, will freeze liquids? A. For this information, see table given in answer to query 4, in SCIENTIFIC AMERICAN for June 21, 1884.

(9) T. F. W. asks what to put with pure white paraffine wax to make it pliable long enough when dipped in water to make imitation of roses. A. Use pure beeswax (white), and mix with paraffin.

(10) W. A. W. writes: Suppose two boilers 200 feet apart are connected by a 2 inch pipe, fire beneath one only, and gauge shows 150 pounds pressure. Would a gauge on the other boiler indicate same or less pressure, and if less, about what per cent? And would size of pipe or distance of boiler cut any figure? A witness in court testified pressure would be materially less in the distant boiler, owing to condensation, but I would prefer to have you say whether he is correct before I can believe so. A. The gauge on the farther boiler would indicate at first considerably less pressure, until the boiler and pipe had become heated by the condensing steam, when the gauges would indicate less difference, but the pressures would never be quite equal. A great deal depends upon the amount of surface exposed in pipe and boiler, and the outside temperature, in determining the per cent difference The witness was correct.

(11) G. F. F. asks how to mix South Carolina rock (finely ground) with sulphuric acid so as to analyze 14 to 15½ per cent of available phosphoric acid; what quantity of each to use. A. Take 1,000 tons or parts of the rock and 1,000 tons of sulphuric acid. 2. What grade of sulphuric acid? A. Sulphuric acid of 50° Baume. 3. Is there any artificial way of drying the mixture? A. It is not necessary to dry it. 4. Is South Carolina rock phos. as high in phosphoric acid when just mixed as it will be after lying a month, or does age improve it? A. The phosphoric acid reverts if allowed to rest for any length of time.

(12) L. H. M.—For information on lubricants, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 316. For axle grease: Dissolve ½ pound common soda in 1 gallon water, add 3 pounds tallow and 6 pounds palm oil (or 10 pounds palm only). Heat them together to 200° or 210° Fah., mix, and keep the mixture constantly stirred till the composition is cooled down to 60° or 70°.

(13) D. D. L. desires a formula for making a good applicant (resin or rosin) for the bow of a double bass, something with lots of "hold fast" in it. The objection to most which is kept for sale in music houses is its tendency to prevent vibration rather than increase it. A. If the resin is too sticky, as we infer from your communication, the best thing to do is to reboil it, when it will be found more satisfactory. If too hard, keep it in a warm room for several days.

(14) L. L. asks for formulas for making ordinary blue prints. A. See SCIENTIFIC AMERICAN of October 31, 1885, Photographic Notes, page 276.

(15) S. desires a recipe for cleaning micas in stoves. A. It is not possible to perfectly restore the micas after they have once been burned. Rubbing with a little alcohol and water may improve them slightly.

(16) J. G. H. asks the best means of precipitating lead in solution in strong water of ammonia without injuring the water of ammonia. A. Metallic zinc has the property of reducing lead to its metallic state when in solution. This method does not always give satisfaction. For the complete separation of the lead, it is best to treat the solution with the gas of hydrogen sulphide. See Fresenius' Qualitative Analysis.

(17) Machinist asks for a recipe to renew an old rubber coat or gossamer. A. Brush over with a solution of ½ ounce of pure rubber dissolved in 1 pint of carbon disulphide. By proper treatment and a series of coats a deposition of rubber on the fabric will be obtained. See "Rubber Waterproof Goods," in SCIENTIFIC AMERICAN SUPPLEMENT, No 251.

(18) W. W. K.—Alcohol contains 91 per cent ethyl alcohol by weight, and has a specific gravity of 0·820 at 60° Fah. Proof spirit contains 49·24 per cent alcohol and 50·76 per cent water, and it has a gravity of 0·919 at 60° Fah. In other words, it is 50 per cent alcohol. Salep is the name given to dried timbers of numerous species of the genus *Orchis*, and in India of the genus *Eulophia*. Leading druggists can obtain it for you.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

A. C. V.—The specimen is a white clay or kaolinite. It is valuable in the manufacture of pottery. It is found in various sections of the country. We would advise you to send it to some maker of pottery in your vicinity, in order that its burning qualities may be tested.—J. M.—The reddish specimen is a variety of clay, and from a superficial examination we think it has the properties of a fire clay. It would be necessary to test its burning qualities in order to positively determine this fact. The powder sent is likewise a clay containing iron and probably manganese. It does not seem to be of any value. C. H. C.—The specimen sent is a bit of manufactured wire, and is probably a piece of the drill which in some way has been broken off at the end.—W. A.—The powder is simply a clay highly colored with metallic oxides, probably iron.

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November 10, 1885,

AND EACH BEARING THAT DATE.

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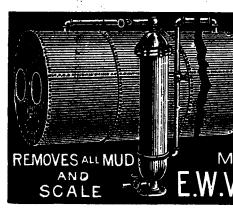
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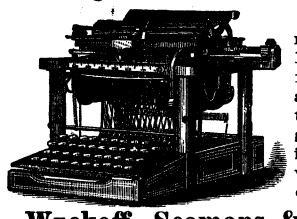

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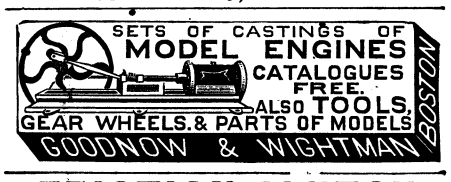
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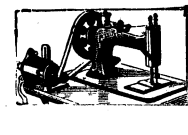
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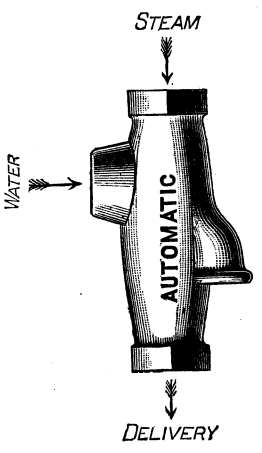

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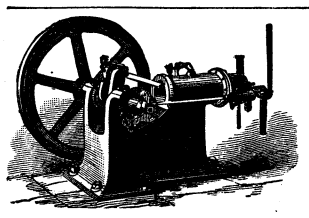

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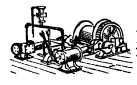

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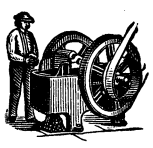

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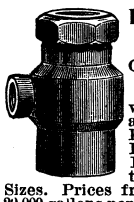

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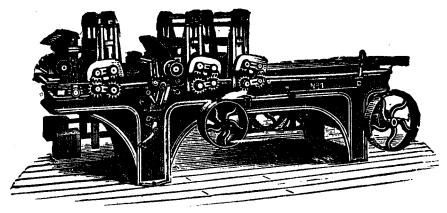

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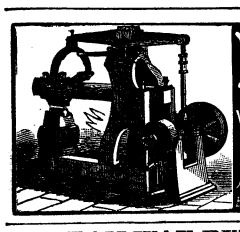
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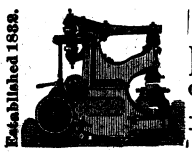
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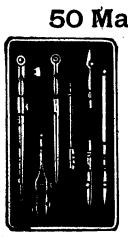
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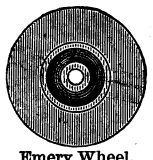
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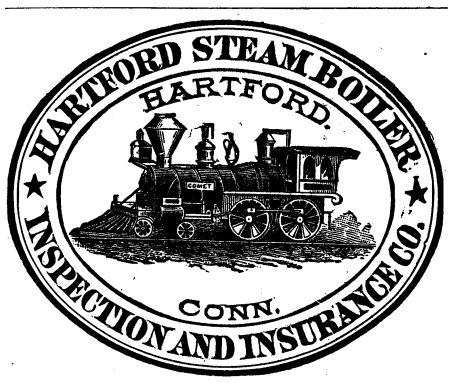

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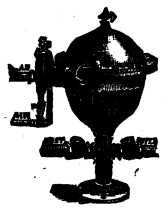
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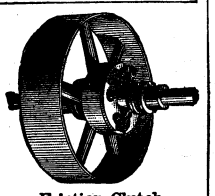
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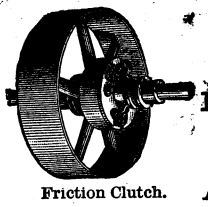
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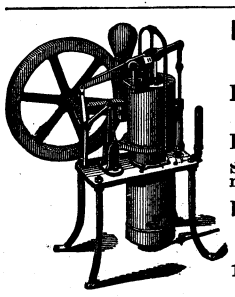
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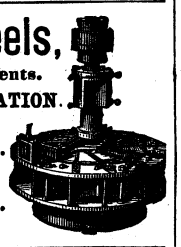

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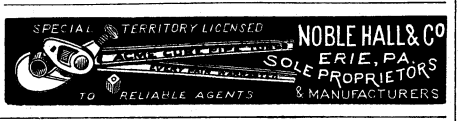

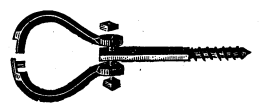
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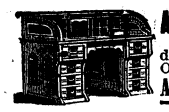
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